PRELIMINARY DRAFT-NOT TO BE RELEASED FOR IMPLEMENTATION
TCS104

Tactical Control System (TCS)

System/Subsystem Design Description (SSDD)

Contract Number

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Prepared for:

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Prepared by:

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Acronym List

Term	Definition
A	Analysis
A&T	Acquisition and Technology
A/C	Aircraft
A/D	Analog to Digital
A/P	Autopilot (AP)
A/V	Air Vehicle (AV)
A3I	Accelerated Architecture Acquisition Initiative (CIO)
AAP	Application Area Profile
ABCS	Army Battle Command System
AC	Alternating Current
ACAAM	Air Courses of Action Assessment Model (PTW)
ACCS	Army Command & Control System Message Catalog
ACE	Analysis and Control Element
ACR	Armored Cavalry Regiment
ACRM	Aircraft Collection Requirements Message.
ACS	Aerial Common Sensor
ACS/IPF	Guardrail Common Sensor/Aerial Common Sensor/Integrated Processing Facility
ACTD	Advanced Concept Technology Demonstration
ACUS	Army Common User System
ADCS	Aircraft Digital Control System
ADDISS	Advanced Deployable Digital Imagery Support System (USAF)
ADITS	Adopted Information Technology Standards
ADO	Army Digitization Office
ADOCS	Automated Deep Operations Coordination System
ADP	Automatic Data Processing
ADR	Airborne Data Relay
ADRG	Arc Digitized Raster Graphic
ADT	Air Data Terminal Airborne Datalink Terminal
AEP	Application Environment Profiles
AFATDS	Advanced Field Artillery Tactical Data System
AFMSS	Air Force Mission Support System
AGF-3	USS LASALLE
AGF-11	USS CORONADO
AGL	Above Ground Level
AICGS	Advanced Imagery Common Ground Station
AIS	Automated Information System
AITS	Adopted Information Technology Standards
ALS	Airborne Link Segment (CARS)
ALT	Altitude
AMPS	Army Mission Planning System

ANSI ..... American National Standards Institute
AOA..... Angle of Attack
API..... Application program interfaces
APS ..... ASARS Processing Segment (CARS)
ARB ..... Asynchronous AS-422 Bus
ARITA ..... Airborne Reconnaissance Information Technical Architecture
ARP..... Antenna Reference Point
ARPA..... Advanced Research Projects Agency
ARTAPP ..... Airborne Reconnaissance Technical Architecture Program Plan (DARO)
AS ..... All Source
AS W/S ..... All Source Work Station
ASARS..... Advanced Synthetic Aperture Radar System
ASARS-2 ..... Advance Synthetic Aperture Radar System
ASAS ..... All Source Analysis System
ASAS-E ..... ASAS-Extended
ASB..... Asynchronous Serial Bus
ASCII ..... American National Standard Code for Information Interchange
ASD ..... Assistant Secretary of Defense
ASI..... Aeronautical System, Inc.
ASIP..... All Source Imagery Processor (USMC)
ASPO ..... Army Space Program Office
ATA ..... Army Technical Architecture
ATARS ..... Advanced Tactical Air Reconnaissance System
ATC ..... Air Traffic Control
ATCCS ..... Army Tactical Command Control System
ATD ..... Advanced Technology Demonstration
ATHS..... Automated Target Hand-off System
ATI..... Artillery Target Intelligence
..... Area Target Indicator (from MIL-STD-6040)
ATI.ATR..... Artillery Target Intelligence – Artillery Target Report (from CJCSM 6120.05). Exchanges target artillery information
ATI.CDR..... Artillery Target Intelligence Coordinate Report
ATM ..... Asynchronous Transfer Mode
ATO ..... Air Tasking Order
ATR ..... Automatic Target Recognition
ATR ..... Automatic Target Recognition
ATWCS ..... Advanced Tactical Weapons Control System
AUTODIN ..... Automatic Digital Network
AV..... Air Vehicle
AVO..... Air Vehicle Operator
AWE ..... Advanced Warfighting Experiment
BDA..... Battle Damage Assessment
BE ..... Basic Encyclopedia
BER..... Bit Error Rate
BITE..... Built In Test Equipment
BNC ..... A type of bayonet electrical connector
BRIL ..... Basic Resource Item List

BTU ..... British Thermal Unit
BUD ..... Back-Up Dissemination
Byte ..... Eight bits; historically, one word of data
C-130 ..... A type of transport aircraft
C2S2 ..... Command and Control and Subordinate Systems
C3I ..... Command, Control, Communications, and Intelligence
C^4I ..... Command, Control, Communication, Computer, and Intelligence
C^4ISR ..... C^4I Systems – Reconnaissance
CADRG ..... Compressed Arc Digitized Raster Graphic
CAF ..... Catalog Access Facility
CAMPS ..... Compartmented ASAS Message Processing System
CARS ..... Contingency Airborne Reconnaissance System
Common Automated Recovery System. A UAV term.
CATIS ..... Computer Aided Tactical Information System
CBDS ..... Central Data Base Server
CCITT ..... International Telephone and Telegraph Consultative Committee
CCRP ..... Collection Central Reference Point
CCS ..... Communications Control Set
CCTV ..... Closed Circuit Television
CD ROM ..... Compact Disk Read Only Memory
CDL ..... Common data link
CDR ..... Chemical Downwind Report (from MIL-STD-6040)
CEP ..... Circular Error Probability
CERL ..... Construction Engineering Research Laboratories
CFS ..... Center for Standards
CGS ..... Common Ground Station
CHA ..... Chemical hazard area
CHBDL ..... Common High Bandwidth Data Link. A variant of CDL.
CHBDL-ST ..... Common High Bandwidth Data Link Surface Terminal
CHS ..... Common Hardware/Software
CHT ..... Cylinder Head Temperature
CIGSS ..... Common Imagery Ground/Surface System
CIIF ..... Common Imagery Interoperability Facilities
CIIP ..... Common Imagery Interoperability Profile
CIIWG ..... Common Imagery Interoperability Working Group
CINC ..... Commander in Chief
CINF ..... Community Imagery Needs Forecast (CIO)
CIO ..... Central Imagery Office
CIP ..... Common Imagery Processor
CIRC ..... Circular
CJCSM ..... Commander Joint Chiefs of Staff Memorandum
CM ..... Configuration Management
Collection management. An intelligence community term.
CMO ..... Central MASINT Office
CNR ..... Combat Net Radio
COE ..... Common Operating Environment
COM ..... Character-Oriented Message

COMPASS..... Common Operational Modeling, Planning, and Simulation System
COMPUSEC..... Computer Security
COMSEC..... Communications Security
CONUS..... Continental United States
COP..... Common Operational Picture
CORBA..... Common Object Request Broker Architecture
COS..... Communications Segment (CARS)
COSIP ..... Computer Open Systems Interface Processor
COTS ..... Commercial Off-the-Shelf
CPS ..... Communications Processing Subsystem
CPU..... Central processing unit
CRD ..... Compass Rose Display
CRP..... Central Reference Point
CSARP..... Common SAR Processor
CSC..... Computer Software Component
CSCIs..... Computer Software Configuration Items
CSM..... CIGSS System Manager
CSMA/CD ..... Carrier Sense Multiple Access with Collision Detection
CSP ..... Communication Support Processor
CSS ..... Communications Support Segment
CSU..... Computer Software Unit
CSWG..... CIGSS Standards Working Group
CUBIC ..... Common User Baseline Intelligence Community
CUCV ..... Commercial untility cargo vehicle. A military pick-up truck
CV-62..... USS Indianapolis
CV-63..... USS Kitty Hawk
CV-64..... USS Constellation
CVN-65..... USS Enterprise
CV-67..... USS John F. Kennedy
CVN-68..... USS Nimitz
CVN-69..... USS Eisenhower
CVN-70..... USS Vinson
CVN-71..... USS Theodore Roosevelt
CVN-72..... USS Lincoln
CVN-73..... USS George Washington
CVN-74..... USS John C. Stennis
CWAN ..... Coalition WAN
CWS..... Collateral Workstation
D ..... Demonstration
D/A ..... Digital to Analog
DAMA ..... Demand-Assignment Multiple Access
DARO ..... Defense Airborne Reconnaissance Office
DARP..... Defense Acquisitions Reconnaissance Program
DBMS ..... Database Management System
DC..... Direct current
DCGS..... Distributed Common Ground Station
DCN..... Document Control Number

DCRSI..... Digital Cassette Recording System Improved
DCT ..... Digital Communications Terminal
Discrete Cosine Transform
DCTN ..... Defense Communications Telecommunications Network
DDCMP ..... Digital Data Communications Message Protocol
DDE ..... Direct Dissemination Element
DDS ..... Defense Dissemination System
DE/PL ..... Data Exploitation/Payload Control
DEMPC..... Data Exploitation, Mission Planning, and Communications
Data Exploitation and Mission Planning Console
DFAD..... Digital Feature Analysis Data
DFP ..... Desired Flight Profile
DGCS..... Digital Ground Control System
DIA ..... Defense Intelligence Agency
DID ..... Data Item Description
DII..... Defense Information Infrastructure
DII/COE..... Defense Information Infrastructure/Common Operating Environment
DIOP ..... Digital Input Output Port
DISA ..... Defense Information Systems Agency
DISN ..... Defense Information System Network
DIWSA ..... Digital Imagery Workstation Suite Afloat (JSIPS-N)
DL ..... Data Link
DLTV..... Daylight Television
DMA ..... Defense Mapping Agency
DMS..... Defense Message Serivce
DNVT ..... Digital Non Secure Voice Telephone
DoD..... Department of Defense
DoDI ..... Department of Defense Instruction
DoDIIS..... Department of Defense Intelligence Information System
DPCM ..... Differential Pulse Coded Modulation
DPI..... Dots Per Inch
DPS ..... Digital Products Server (a JMCIS term)
Data Processing Set
DS ..... Data Server
DSVT..... Digital Secure Voice Telephone
DT&E ..... Developmental Test and Evaluation
DTED..... Digital Terrain Elevation Data
EAC ..... Echelon above Corps
ECCM..... Electronic Counter Counter Measures
ECF..... Earth Centered Fixed
ECU ..... Environmental Conditiioning Unit
EDS..... Extended Data Services
EEI ..... Essential Elements of Information
External Entity Interfaces
EGT..... Exhaust Gas Temperature
ELT..... Electronic Light Table
Emergency Locator Transmitter

EMI ..... Electromagnetic Interference
EMTI..... Enhanced Moving Target Information
EO ..... Electro-optical
EO LOROPS..... EO Long-range Oblique Photography Sensor
EO/IR ..... Electro-optical/Infrared
EOS..... Earth Observing System
EPLRS ..... Enhanced Position Location Reporting System
EPROM..... Erasable Programmable Read-Only Memory
EPUU ..... Enhanced PLRS Users Unit
ESS ..... Exploitation Support Segment
ETP ..... Extended Tether Program
ETRAC ..... Enhanced TRAC (Tactical Radar Correlator)
ETUT ..... Enhanced Tactical Users Terminal
EW ..... Electronic Warfare
FAA ..... Federal Aviation Administration
FAD ..... Functional Area Designator
FATDS..... Field Artillery Tactical Data System
FD/L..... Fault Detection / Location
FDC..... Fuel/Defuel Cart
FDDI ..... Fiber-Distributed Data Interface
FDMP ..... Full Duplex Message Protocol
FDS ..... Fire Direction System (an Army artillery term)
FEBA ..... Forward Edge of Battle Area
FEC ..... Forward Error Correction
FEC-I..... Forward Error Correction (effectivity 1)
FEC-II ..... Forward Error Correction (effectivity 2)
FFT ..... Fast Fourier Transform
FGDC..... Federal Geographic Data Committee
FH ..... Frequency Hopping
FIPS ..... Federal Information Processing Standard
FISC..... Forward Sensor Interface and Control
FLCS..... Force Level Control System
FLIR..... Forward Looking Infrared
FM ..... Frequency Modulation
FOMAU..... Fiber Optic Media Access Unit
FOV ..... Field Of View
FPN..... Focus Plane Normal Vector
FRAGO..... Fragmentary Orders
FRP ..... Fiberglass Reinforced Plastic
FSD..... Fixed Shroud Duplex
FSK ..... Frequency Shift Keying
FTP ..... File transfer protocol. Defined in MIL-STD-1778
FTP ..... File Transfer Protocol
G2 RWS..... G2 Remote Work Station
G2-TOC ..... G2 Tactical Operations Center
GA..... General Atomics
GA/ASI..... General Atomics Aeronautical Systems, Inc.

GB ..... Gigabyte, 1,000 Megabytes (10 to 9th power)
Gbps ..... Gigabit per second
GBS ..... Global Broadcasting System
GCCS ..... Global Command and Control Systems
GCS ..... Ground Control Station
GCS/ACS ..... Guardrail Common Sensor/Aerial Common Sensor
GDT ..... Ground Data Terminal
Ground Datalink Terminal
GFE ..... Government Furnished Equipment
GFI ..... Government Furnished Information
GIS ..... Geographical Information System
GMPS ..... Graphical Mission Planning System
GMT ..... Greenwich Mean Time
GNC ..... Global Navigation Chart
GOTS ..... Government off the shelf
GPC ..... Ground Power Cart
GPS ..... Global Positioning System
GSD ..... Ground Sample Distance
Graphics Situation Display
GSE ..... Ground Support Equipment
GSM ..... Ground Station Module
GSM/CGS ..... Ground Station Module/Common Ground Station
GSS ..... Ground/Surface System(s)
GUI ..... Graphical User Interface
HAE ..... High Altitude Endurance
HAE UAV ..... High Altitude Endurance Unmanned Aerial Vehicle
HCI ..... Human-Computer Interface
HCU ..... High Capacity Computer Unit
HDBK ..... Handbook
HdbK ..... Handbook
HDBS ..... Host Data Base System
HDD ..... Hardware Design Document
HDG ..... Dearing
HDLC ..... High-level Data-link Control
HDTV ..... High Definition Television
HERO ..... Hazards of Electromagnetic Radiation to Ordnance
HES ..... Hardcopy Exploitation Segment
HFE ..... Human Factors Engineering
HHV ..... Heavy HMMWV Variant
Hi8 ..... Hi-band 8mm magnetic tape format
HiPPI ..... High Performance Parallel Interface
HiPPI-FP ..... HiPPI framing protocol
HiPPI-PH ..... HiPPI Mechanical, electrical, and Signaling Protocol
HiPPI-PH ..... HiPPI Physical Layer
HMMWV ..... High Mobility Multi-purpose Wheeled Vehicle
HMMWV-HV ..... HMMWV-Heavy Variant
HRU ..... Hardcopy reconstruction unit

High resolution unit

HUD ..... Heads-Up Display
HWCIs ..... Hardware Configuration Items
I ..... Inspection
I&RTS ..... Integration and Runtime Specification
I/F ..... Interface
IA ..... Imagery Analyst
IAF ..... Image Access Facility
IARS ..... Integrated Airborne Reconnaissance Strategy
IAS ..... Intelligence Analysis System
IASS ..... Image Access Services Specification
IAW ..... In Accordance With
IBLS ..... Integrity Beacon Landing System
IC ..... Intelligence Community
ICD ..... Interface Control Document
ICMP ..... Internet Control Message Protocol
ICOM ..... Integrated Communications Security Module
ID ..... Identification
IDBTF ..... Integrated Data Base Transaction Formatted
IDD ..... Interface Design Description
IDF ..... Imagery Dissemination Facility
IDL ..... Interoperable Data Link
IDPS ..... Integrated Deployable Processing System
IEC ..... International Electro-technical Commission
IEEE ..... Institute of Electrical and Electronic Engineers
IES ..... Imagery Exploitation Segment (CARS)
IESS ..... Imagery exploitation support system
IESS ..... Imagery Exploitation Support System
IEW ..... Intelligence and Electronic Warfare
IEWCOMCAT ..... Integrated Electronic Warfare Character Oridented Message Catalog
IFF ..... Identification Friend or Foe
IFOV ..... Instantaneous Field Of View
IFSAS ..... Initial Fire Support Automated System (an Army artillery term)
IFT ..... Inverse Fourier Transform
IIN ..... Imagery Information Need
IIRS ..... Imagery Interpretability Rating Scale
ILSP ..... Integrated Logistics Support Plan
IMINT ..... Imagery Intelligence
IMTS ..... Initial Main Text Sets
INS ..... Inertial Navigation System
INT ..... Intelligences
IP ..... Internet protocol
IPA ..... Image Product Archive
IPDS ..... Imagery Processing and Distribution System (Army)
IPF ..... Integrated Processing Facility
IPL ..... Image Product Library
IPR ..... Impulse Response

IPT ..... Integrated Product Team
IR ..... Infrared
IRIG ..... InterRange Instrumentation Group
IRLS..... Infrared Line Scanner
IRS ..... Interface Requirements Specifications
ISE ..... Intelligence Support Element
ISO..... International Standard Organization
ISO/OSI..... International Standards Organization/Open Systems Interface (Protocol Reference Model)
ITS ..... Image Transformation Services
ITU-TS..... International Telecommunications Union, Teleconferencing Sector
IVS..... Integrated Video Subsystem
IWSDB..... Integrated Weapon System Database
JAC ..... Joint Analysis Center (Molesworth, UK)
JASA..... Joint Airborne SIGINT Architecture
JCMT ..... Joint Collection Management Tool
JCS..... Joint Chiefs of Staff
JDISS ..... Joint Deployable Intelligence Support System
JIC..... Joint Intelligence (Information) Center
JIEO ..... Joint Interoperability and Engineering Office (DISA)
JII ..... Joint Interoperability Interface
JMCIS ..... Joint Maritime Command Information System
JMF..... Joint Message Format
JNC ..... Jet Navigation Chart
JOG..... Joint Operation Graphic
JORD ..... Joint Operational Requirements Document
JPATS..... U. S. Joint Primary Aircraft Training System
JPEG ..... Joint Photographic Experts Group
JPO..... Joint Project Office
JROC..... Joint Requirements Oversight Council
JROCM..... JROC Memorandum
JSIPS..... Joint Service Imagery Processing System.
JSIPS-AF ..... Joint Service Imagery Processing System – Air Force
JSIPS-N..... Joint Service Imagery Processing System – Navy
JSTARS ..... Joint Standoff Target Attack Radar System
JSTARS GSM/CGS ..... Joint Standoff Target Attack Radar System Ground Station Module/Common Ground Station
JTDLMP ..... Joint Tactical Data Link Management Plan
JTA ..... Joint Technical Architecture
JTC/SIL..... Joint Technology Center/System Integration Laboratory
JTF..... Joint Task Force
JTIC ..... Joint Interoperability Test Center
JTT ..... Joint Tactical Terminal
JWICS..... Joint Worldwide Intelligence Communications System
JWID97..... Joint Warrior Interoperability Demonstration 1997
K ..... Kilo (1000)
KB..... kilobyte

Kbps ..... kilobit per second
KCOIC ..... Korean Combat Operations Intelligence Center
kHz ..... Kilohertz
KIAS ..... Knots Indicated Airspeed
KW ..... Kilowatts
LAN ..... Local Area Network
LCC 19 ..... USS Blue Ridge
LCC-20 ..... USS Mount Whitney
LCD ..... Liquid Crystal Display
LCM ..... Low cost media
LCU ..... Lightweight Computer Unit
LEN ..... Large Extension Node
LHA-1 ..... USS Tarawa
LHA-2 ..... USS Saipan
LHA-3 ..... USS Belleau Wood
LHA-5 ..... USS Peleliu
LHD-1 ..... USS Wasp
LHA-2 ..... USS Essex
LHD-3 ..... USS Kearsarge
LHD-4 ..... USS Boxer
LHD-6 ..... USS Richard
LMS ..... Lightweight Multipurpose Shelter. A shelter that fits on a HMMWV-HV
LO HAE ..... Low Observable High Altitude Endurance (UAV)
LOL ..... Loss of Link
LOROPS ..... Long-range Oblique Photography Sensor
LOS ..... Line of Sight
LRC ..... Lesser Regional Conflict
LRIP ..... Low Rate Initial Production
LRU ..... Line Replaceable Unit
LTMS ..... Light Table Mensuration System
LUT ..... Look Up Table
LWCM ..... Left Wing Control Module
MAC ..... Medium-access control
MAE ..... Medium Altitude Endurance (UAV)
MAP ..... Manifold Air Pressure
MASINT ..... Measurements and Signatures Intelligence
MCE ..... Mission Control Element
MCP ..... Motion Compensated Prediction
MCS ..... Maneuver Control System
MCS-?? ..... USS INCHON
MCT ..... Manifold Charge Temperature
MEA ..... Medium Altitude Endurance
METT-T ..... Mission, Enemy, Troops, Terrain, and Time
MFLOPs ..... Million Floating Point Operations per Second
MGRS ..... Military Grid Reference System (UTM)
MHz ..... Megahertz

MI..... Military intelligence
MIES..... Modernized Imagery Exploitation System
MIGS ..... Multi-Source Intelligence Ground System
M JPEG..... Motion JPEG
MIL ..... military
MIL-HDBK ..... Military Handbook
MILSTAR..... Military Strategic and Tactical Relay (satellite)
MIL-STD ..... Military Standard
MIPE..... Mobile Imagery Processing System
MIPS ..... Millions of Instructions per Second
MIS ..... Management Information System
Mission Intelligence Segment (CARS)
MM ..... Mission management
MITRE..... Massachusetts Institute of Technology (MIT) Research
MNS..... Mission Need Statement
MOBSTR..... Mobile Stretch
MOPP ..... Mission Oriented Protective Posture
MP/M..... Mission Planning/Monitoring
MPEG ..... Motion Picture Experts Group
MPEG-1..... Originally intended for used with digital storage media operating at up to 1.544 MBPS. Rates up to 105 MBPS are allowable. Suited for movies on demand including use of CD-ROMs because it is optimized for progressive scanned source material (i.e., film)
MPEG-2..... Optimized for higher data rate interlaced video applications. Can operate at rates from 384 KBPS to 100 MBPS. MPEG-2 decoders can decode MPEG-1 signals, but the inverse is not true.
MPEG-4..... Aims to develop audiovisual coding schemes for low bit rate wireless communications. Uses object-based encoding. Targets TV, film, computer, and wireless telecommunications. Due to be finalized as a standard in 1998.
MPN..... MSE Packet Switching Network
MPT ..... Man-Pack Terminal
MRC ..... Major Regional Conflict
MSE ..... Mobile Subscriber Equipment
Msgs..... Messages
MSI ..... Multi-Spectral Imagery
MSL ..... Mean Sea Level
MSRT ..... Mobile Subscriber Radiotelephone Terminal
MTBF ..... Mean Time Between Failure
MTI..... Moving Target Indicator
MTTR ..... Mean Time To Repair
MUSE ..... Multiple UAV Simulation Environment
NACA ..... National Advisory Board for Aeronautics
NB..... Narrow Band
NCS..... Net Control Station
NDI ..... Non-Developmental Items
NDS ..... National Dissemination System

NED ..... North East Down Coordinate System
NETBLT ..... Network Block Transfer (protocol
NETD..... Noise Equivalent Temperature Differential
NFS ..... Network File System
NIC..... National Intelligence Community
NIIRS ..... National Imagery Interpretation Rating Scale
NIMA..... National Imagery & Mapping Agency
NIS ..... National Input Segment
NIST..... National Intelligence Support Team
National Institute of Standards and Technology
NITF..... National Imagery Transmission Format
NITFS ..... National Imagery Transmission Format Standard
NMJIC ..... National Military Joint Intelligence Center
NPIC ..... National Photographic Interpretation Center
NRO..... National Reconnaissance Office
NRP..... Net Radio Protocol
NRT ..... Non Real Time
NSA ..... National Security Agency
NSFS..... Naval Surface Fire Support
NSWCDD..... Naval Surface Warfare Center Dahlgren Division
NTB ..... NTIF Technical Board
N-TIS ..... JSIPS US Navy – Tactical Input Segment
NTSC..... National Television Standards Committee
NWCS-P ..... NSFS Weapon Control System – Prototype
OAT ..... Outside Air Temperature
OC-n..... Optical Channel n (e.g., OC-3, OC-48). A SONET term.
ONC..... Operation Navigation Chart
OO..... Object Oriented
OOA..... Object Oriented Analysis
OODBMS ..... Object Oriented DBMS
OOT ..... Object Oriented Technology
OOTW ..... Operations Other Than War
ORD..... Operational Requirements Document
ORP..... Output Reference Point
OSD ..... Office of the Secretary of Defense
OSI..... Open Systems Interconnection
OT..... Operate Time
P&NF ..... Profile and Notification Facility
P3I..... Preprogrammed Product Improvement
Pre-planned Product Improvements
PAL..... Phased Altered Line
PCM..... Primary Control Module
PDU ..... Protocol Data Units
PGM..... Precision Guided Munitions
PINES ..... Pacific Air Forces Interim National Exploitation System
PLA ..... Plain Language Address
PLL ..... Phase Lock Loop

PMD..... Physical Medium Dependent
PMO..... Program Management Office
PMS ..... Precision Mensuration System
PO ..... Payload Operator
POL..... Petroleum, Oil, Lubricants
POSIX..... Portable Operating system Interface for Computer Environments
PPO ..... Pilot/Payload Operator
PTM ..... Plain Text Message
PTT ..... Push To Talk
PTW..... Precision Targeting Workstation
PWA ..... Printed wire Assemble
PYLD..... Payload
QCIF ..... Quarter Common Intermediate Format
RAD IPT..... Requirements, Analysis, and Design Integrated Product Team
RAID..... Redundant Arrays of Inexpensive Disks
RAM ..... Random Access Memory
RATT..... Radio Teletypewriter
RDBMS ..... Relational DBMS
RECCEXREP ..... Reconnaissance Exploitation Report
RED ..... A term describing classified information that requires protection. Contrast with BLACK information which is information that does not require protection. BLACK information may be information that was unclassified in its original or information that was classified in its original form (i.e., RED) and has subsequently been rendered incomprehensible through encryption techniques.
RFC..... Request for Comment. An Internet standard
RFP ..... Request for Proposal
RG-58/U..... A standardized type and impedance code designation for 50 ohm coaxial cable
RG-59/U..... A standardized type and impedance code designation for 50 ohm coaxial cable
RGB ..... Red, Green, Blue
RGM ..... Mid-Array Ground Plane Range
RISC..... Reduced Instruction Set Computers
RIGS ..... Reconnaissance/Intelligence Ground Systems
RJ-48..... A standardized type and size designation for a telephone wire connector
RMG ..... Mid-Array Ground Plane Range
RMS..... Requirements Management System
ROM ..... Read Only Memory
RPC..... Rapid Positioning Capability
RPM..... Revolutions Per Minute
RRIS..... Reduced Resolution Image Set
R-sets ..... Reduced resolution sets
RSM..... Mid_Array Slant Plane Range
RSTA ..... Reconnaissance, Surveillance and target Acquisition
RTIC ..... Real-Time Information to the Cockpit
RTOS ..... Teal Time Operation System

RTP ..... Remote Tape Processor
RULER ..... A software application for doing mensuration and related analysis functions
RWCM..... Right Wing Control Module
RWS..... Remote Workstation
S ..... Special
SADT..... Satellite Air Data Terminal
SALUTE ..... Size, Activity, Location, Unit, Time, Equipment
SAMs ..... Surface to Air Missiles
SAR..... Synthetic Aperture Radar. Requires 122 Mbps per CIGSS document
SATCOM..... Satellite Communications
SBS ..... Senior Blade Segment (CARS)
SCI ..... Sensitive Compartmented Information
SCM..... Secondary Control Module
SCSI..... Small Computer System Interface
SCSI-2..... Small Computer System Interface (version 2)
SDE..... Support Data Extensions. These are fields defined in NITF documents.
SDH ..... Synchronous Digital Hierarchy
SDTV..... Standard Definition Television
SEN..... Small Extension Node
SENDS..... A sample implementation of the NITFS in software that provides an example of an NITFS software engine
SEP ..... Signal Entry Panel
SEP BDE..... Separate Brigade
SES ..... Softcopy Exploitation Segment
SGDT..... Satellite Ground Data Terminal
SICPS..... Standardized Integrated Command Post System
SID ..... Secondary Imagery Dissemination
SIDS..... Secondary Imagery Dissemination System
SIGINT ..... Signals Intelligence
SINCGARS..... Single Channel Ground and Airborne Radio System
SIPRNET ..... Secret Internet Protocol Router Network
SLIP/PPP ..... Serial Line Internet Protocol/Point to Point Protocol
SMTP..... Simple Mail Transport Protocol
SNMP ..... Simple Network Management Protocol
SONET ..... Synchronous Optical Network
SONET/SDH ..... Synchronous optical network/synchronous digital hierarchy
SP..... Standardized Profiles
SPIA..... USIS Standard Profile for Image Archives
SPIRIT ..... Special Purpose Integrated Remote Intelligence Terminal
SPIRIT II..... TROJAN Special Purpose Integrated Remote Intelligence Terminal, second design
SPMA ..... Signal Processor Modem Assembly
SPTE..... Special Purpose Test Equipment
SQL..... Structured Query Language
SRS ..... Software Requirements Specification
SS..... Single Source

SS W/S ..... Single Source Work Station
SSDD ..... System/Subsystem Design Document
SSS ..... System / Subsystem Specification
System Support Segment
ST ..... Stand-by Time
A type of optical connector
STANAG ..... Standardization Agreement (NATO)
STAR ..... System Threat Assessment Report
STD ..... Standard
STU-III ..... Secure telecommunication Unit – third generation
S-VHS ..... Super VHS
SVT ..... Surface Vehicle Terminal
SYERS ..... Senior Year Electro-optical Reconnaissance System
T ..... Test
TACCOM ..... Tactical Communications
TACFIRE ..... Tactical Fire (direction system)
TACO-2 ..... Tactical Communications (protocol) version 2
TACREP ..... Tactical Report
TADIL ..... Tactical Data Information Link
TADIXS ..... Tactical Data Information Exchange Service
TAFIM ..... DoD Technical Architecture Framework for Information Management
TALDT ..... Total Administrative and Logistic Downtime
TAMPS ..... Tactical Aircraft Mission Planning System
TAP ..... Technical Architecture Plan (see ARTAPP)
TBD ..... To be determined
TBMCS ..... Theater Battle Management Core System
TBMD ..... Theater Ballistic Missile Defense
TBR ..... To be resolved
TCM ..... Total Corrective Maintenance
TCP ..... Transmission Control Protocol. Defined in MIL-STD-1780
TCS ..... Tactical Control System
TCSEC ..... Trusted Computer Security Evaluation Criteria
TE ..... Tactical Endurance
TEC ..... Topographic Engineering Center (USA)
TEG ..... Tactical Exploitation Group
TEMP ..... Test and Evaluation Master Plan
Terabyte ..... 1,000 Gigabytes (10 raised to the 12^{TH} power)
TESAR ..... Tactical Endurance Synthetic Aperture Radar
TFRD ..... Tape Format Requirements Document
TIBS ..... Tactical Information Broadcast System (USAF)
TIDF-TE ..... (VMF) Technical Interface Design Plan – Test Edition
TIDP ..... Technical Interface Design Plan
TIFF ..... Tape Image File Format
TIGDL ..... Tactical Interoperable Ground Data Link
TIP ..... Tent Interface Panel
TIS ..... Tactical Imput Segment
TLM ..... Telemetry

Topographic Line Map
TMDE ..... Test, Measurement, and Diagnostic Equipment
TOC ..... Tactical Operations Center
TPC ..... Tactical Pilotage Chart
TPM ..... Total Preventative Maintenance
TPN ..... Tactical Packet Network
TPS ..... Tomahawk Planning System
TRAC ..... Tactical Radar Correlator (U2) (USA)
USA TRADOC Analysis Center (FT Leavenworth, KS)
TRADOC ..... Training and Doctrine (Army TRADOC Command)
TSM ..... Tactical System Manager
TUAV ..... Tactical Unmanned Aerial Vehicle
TV ..... Television
U-AMPUSIS ..... Architecture Migration Plan (CIO)
UAV ..... Unmanned Aerial Vehicle
UAV JPO ..... Unmanned Aerial Vehicle Joint Project Office
UDD ..... User Defined Device
UHDDR ..... Ultra High Digital Data Recorder
UHF ..... Ultra High Frequency
UPE ..... User Portability Extension
UPS ..... Uninterruptible Power Supply
URO ..... User Readout
USA ..... United States Army
USAF ..... United States Air Force
USD ..... Under Secretary of Defense
USIGS ..... United States Imagery and Geospatial Systems
USIS ..... United States Imagery Standards Untied States Imagery System. Elements of the USIS are collection, processing, exploitation, dissemination, archive, management, site infrastructure, and global communications
USMC ..... United States Marine Corps
USMTF ..... United States Message Text Format
USN ..... United States Navy
USSID ..... US Signals Intelligence Directives
UTM ..... Universal Transverse Mercator (MGRS)
VAC ..... Volts Alternating Current
VBI ..... Vertical Blanking Interval
VCR ..... Video Cassette Recorder
VDC ..... Volts Direct Current
VDD ..... Version Description Document
VHF ..... Very High Frequency
VHS ..... Video Helical Scan
VITec ..... Visual Information Technologies
VME ..... Versa Module Europa
VMF ..... Variable Message Format
VOX ..... Voice-Operated Switch
VPP ..... Variable Pitch Propeller

VQ..... Vector Quantization
VSI..... Vertical Speed Indication
VTA..... Visual Targeting Aid
VTC..... Video Teleconferencing
VWG..... Video Working Group
WAMTI..... Wide Area Moving Target Information
WAN..... Wide Area Network
WB..... Wide Band
WBDL..... Wide Band Datalink
WCG..... Work Station, Computer Graphics
WDG..... Wideband Data Group
WGS..... World Geodetic System
WL..... Warlord
WP..... Waypoint
XDDCMP..... External Digital Data Communications Message Protocol
XDS..... Extended Data Services

Chapter 1 Scope

1.1 Identification

This TACTICAL CONTROL SYSTEM (TCS) - SYSTEM / SUBSYSTEM DESIGN DESCRIPTION (SSDD) VERSION 1.0 describes the system or subsystem wide design and architectural design decisions for the Tactical Control System as set forth by the OPERATIONAL REQUIREMENTS DOCUMENT FOR THE UNMANNED AERIAL VEHICLE (UAV) TACTICAL CONTROL SYSTEM (TCS) - VERSION 5.0, and the SYSTEM / SUBSYSTEM SPECIFICATION (SSS) - VERSION 1.0. This SSDD will be supplemented by Interface Design Descriptions (IDDs) (DI-IPSC-81436). Requirements pertaining to the TCS external interfaces will be published in separate Interface Requirements Specifications (IRSs) which will be incorporated into a combined IRS/IDD document. The SSDD is published IAW a tailored DI-IPSC-81432, dated 941205. This SSDD will be revised at the conclusion of the Program Definition and Risk Reduction period of the TCS program based on lessons, insights, and results of the demonstrations conducted during the risk reduction program, and will be re-issued as the TCS System/Subsystem Design Description

This SSDD identifies top level design requirements for a common, modular and scaleable control system for tactical UAVs, which will provide war fighters with a scaleable command, control, communications and data dissemination system for tactical UAVs. The TCS will be compliant with the Joint Technical Architecture (JTA), Airborne Reconnaissance Information Technical Architecture (ARITA) and the Common Imagery Ground/Surface System (CIG/SS), thereby assuring UAV and product interoperability and utility among multiple operational users. Additionally this SSDD will be compliant to the extent possible with the evolving Defense Information Infrastructure (DII) Common Operating Environment (COE). This SSDD, with its associated IRSs/IDDs, will be used as a basis for further system development. Throughout the SSDD the term "system" may be interpreted to mean "subsystem" as appropriate.

1.2 System Overview

The purpose of the TCS is to provide the military services with a single command, control, data receipt, data processing, data export and dissemination system that is interoperable with the family of all present and future tactical unmanned aerial vehicles. These UAVs shall include the Tactical Unmanned Aerial Vehicle (TUAV) and the Medium Altitude and Endurance (MAE) UAV (henceforth referred to as Outrider and Predator respectively), their associated payloads, and other network communication systems. TCS will also be capable of receiving and processing information from High Altitude and Endurance (HAE) UAVs, their associated payloads, future development UAVs and payloads. Further discussion on the General Nature of the System is contained in paragraphs 1.2.1 through 1.2.4 below.

During Phase 1 of the TCS development program (see paragraph 1.2.1) Operations and Maintenance of the TCS will be a government responsibility shared between Naval Surface Warfare Center-Dahlgren Division, Dahlgren, Virginia, and the US Army's Joint Test Center/System Integration Laboratory, Redstone Arsenal, Alabama. The specific details and assignment of maintenance responsibility during Phase 2 is still under development in evolving the TCS Acquisition Strategy.

The Defense Airborne Reconnaissance Office (DARO) is the Secretary of Defense level resource sponsor and oversight monitor for the TCS program. The acquirer is to be determined prior to Phase III (Production, Fielding/Deployment, Operational Support and Retrofit). The user includes all Four Military Services. The Developer is the TCS Program Manager (PM-TCS) in the Navy Program Executive Office (PEO) for Cruise Missiles and Unmanned Aerial Vehicles (CU).. Engineering support is provided the Naval Surface Warfare Center (NSWC) Dahlgren Division (DD), the Army's Joint Technology Center/Systems Integration Laboratory (JTC/SIL), the Army Missile Command (MICOM) and other field activities and support offices.

Operating sites will initially include land based and sea based configurations. During the Phase I (Program Definition and Risk Reduction) three fieldable TCS prototypes (one ship based, two land based) will be developed over a 24 month period. During this phase Predator and Outrider air vehicles and payloads will be integrated with TCS common core functions

1.2.1 TCS Program, Phases, and UAV Interaction

Design and development of the TCS will be conducted in two phases. Phase I is defined as the Program Definition and Risk Reduction phase, and Phase 2 is defined as the Engineering and Manufacturing Development phase in accordance with Department Of Defense Instruction (DODI) - 5000.2R. Phase II will commence TCS Low Rate Initial Production (LRIP). This SSDD focuses primarily on the Phase I and Phase II efforts and will be revised prior to Phase III based on lessons learned during development and Advanced Warfighting Experiments.

Phase 1 will be a 24 month period and will demonstrate Level 1 through Level 5 interaction (as defined below) in an incremental and evolutionary strategy as described in accordance with MIL-STD-498. The five discrete levels of multiple UAV interaction to be provided by the TCS are:

Level 1 - receipt and transmission of secondary payload imagery and/or data;

Level 2 - direct receipt of payload data/imagery ;

Level 3 - UAV payload control and direct receipt of payload data/imagery;

Level 4 - control of the UAV, less launch and recovery, in addition to all functionality of Levels 1 through 3; and,

Level 5 - full functionality and control of the UAV from launch to recovery.

1.2.2 Tactical Control System

The TCS is a software intensive program to provide the warfighter with a scaleable and modular capability to operate UAVs on existing computer systems and interface for dissemination with current and future C4I processing systems. Scaleable refers to the capability to provide the five levels of interaction listed above. Modularity allows the use of common hardware and the ability to increase or decrease capability by adding or removing cards, chips, etc., from the system being used. The TCS consists of the software, software-related hardware and the extra ground support hardware necessary for the control of the TUAV, and the MAE UAV, and future tactical UAVs. The TCS will also provide

connectivity to specifically identified Command, Control, Communications, Computers, and Intelligence (C4I) systems. TCS will have the objective capability of receiving High Altitude Endurance (HAE) UAV payload information. TCS will provide a common Human-Computer Interface (HCI) for tactical airborne platforms to simplify user operations, training, and facilitate seamless integration into the Services' Joint C4I infrastructure across all levels of interaction.

1.2.2.1 Software

The major focus of the TCS program is software. The software will provide the UAV operator the necessary tools for computer related communications, mission tasking, mission planning, mission execution, data receipt, data processing, limited data exploitation, and data dissemination. The software will provide a high resolution computer generated graphics user interface that enables a UAV operator trained on one system to control different types of UAVs or UAV payloads with a minimum of additional training. The TCS will operate in an open architecture and will be capable of hosting on computers that are typically supported by the using Service. Software developed under this program will be non-proprietary and compliant with the Defense Information Infrastructure / Common Operating Environment. Additionally, this TCS software shall become the architectural standard for all future tactical UAVs. To the extent possible, the TCS will use standard DoD software components to achieve commonality. TCS will provide software portability, scaleable functionality, and support for operational configurations tailored to the users' needs.

TCS software will run on current services' hardware such as TAC-X (Navy), CHS-II/SPARC 20 (Army / Marines) and SGI/DEC (Air Force). For the Army and Marine Corps, the TCS will be an integral part of the Outrider, two HMMWV-based, ground control stations (GCS). For the Navy, the TCS will initially support the Outrider and receive Predator payload data aboard L-Class Ships. The TCS will be the control system for future ship based UAVs and UAV operations. Since ships already provide the necessary infrastructure to support a computer based system (e.g., electrical power, environmental control, radio networks, etc.), the TCS is virtually the CGS for the Navy. The Air Force TCS will be an upgrade of the existing GCSs for the MAE UAV.

1.2.2.2 Hardware

To the extent possible, the TCS will use standard Department of Defense (DoD) components in order to achieve commonality. The TCS will use the computing hardware specified by the service specific procurement contracts. The individual armed services will identify TCS computing hardware, the desired level of TCS functionality, the battlefield C4I connectivity, and the particular type of air vehicle and payloads to be operated depending upon the deployment concept and area of operations. TCS hardware must be capable of being scaled or modularized to meet varying Service needs. TCS hardware will permit long range communications from one TCS to another, data storage expansion, access to other computers to share in processing capability, and multiple external peripherals.

1.2.3 Integration with Joint C4I Systems

TCS supports direct connectivity to standard DoD tactical (VHF, UHF, VHF/UHF, and HF) radios, Mobile Subscriber Equipment (MSE), and military and commercial satellite communications. TCS integration with C4I systems will be accomplished through development of interfaces that permit

information exchange between the TCS and specified C4I systems. TCS will be capable of entering DII/COE compliant networks. Network interoperability will include but not be limited to:

Advanced Tactical Weapons Control Station (ATWCS)

Advanced Field Artillery Tactical Data System (AFATDS)

Air Force Mission Support System (AFMSS)

All Source Analysis System(ASAS)

Automated Deep Operations Co-ordination System (ADOCS)

Automated Target Hand-off System (ATHS)

Closed Circuit Television (CCTV)

Common Operational Modeling, Planning, and Simulation System (COMPSS)

Contingency Airborne Reconnaissance System (CARS)

Enhanced Tactical Radar Correlator (ETRAC)

Guardrail Common Sensor/Aerial Common Sensor (ACS)

Integrated Processing Facility (IPF)

Intelligence Analysis System (IAS)

Joint Deployable Intelligence Support System (JDISS)

Joint Maritime Command Information System (JMCIS)

Joint Service Imagery Processing System - Navy (JSIPS-N)

Joint Standoff Target Attack Radar System (JSTARS) Ground Station Module/Common Ground Station (GSM/CGS)

Modernized Imagery Exploitation System (MIES)

Precision Targeting Workstation (PTW)

Tactical Aircraft Mission Planning System (TAMPS)

JSIPS Tactical Exploitation Group (TEG)

Theater Battle Management Core System (TBMCS)

TROJAN Special Purpose Integrated Remote Intelligence Terminal (SPIRIT) II

The TCS will export / disseminate UAV imagery products, tactical communication messages, as well as mission plans and target coordinates. TCS will also receive, process, and display tasking orders, and operational information from Service specific mission planning systems.

1.2.4 System Compliance

The TCS will be developed in compliance with the following military and commercial computing systems architecture, communications processing, and imagery architecture standards:

a) Assistant Secretary of Defense (ASD) (C3I) Joint Technical Architecture (JTA)

b) Airborne Reconnaissance Information Technical Architecture (ARITA)

c) Defense Information Infrastructure (DII) Common Operating Environment (COE)

d) Computer Open Systems Interface Processor (COSIP)

e) Common Imagery Ground/Surface System (CIGSS) Handbook

f) Joint Interoperability Interfaces

g) National Imagery Transmission Format (NITF)

h) Variable Message Format (VMF) and Joint Message Format (JMF)

1.3 Document Overview

The System/Subsystem Design Document (SSDD) is the allocation of the System/Subsystem Specification requirements to the components (HWCIs and CSCIs) and the top level design descriptions of the TCS. Figure 1.3-1 TCS System/Subsystem Design Description (SSDD) provides a visual depiction of the document overview, purpose, and role in the TCS development process.

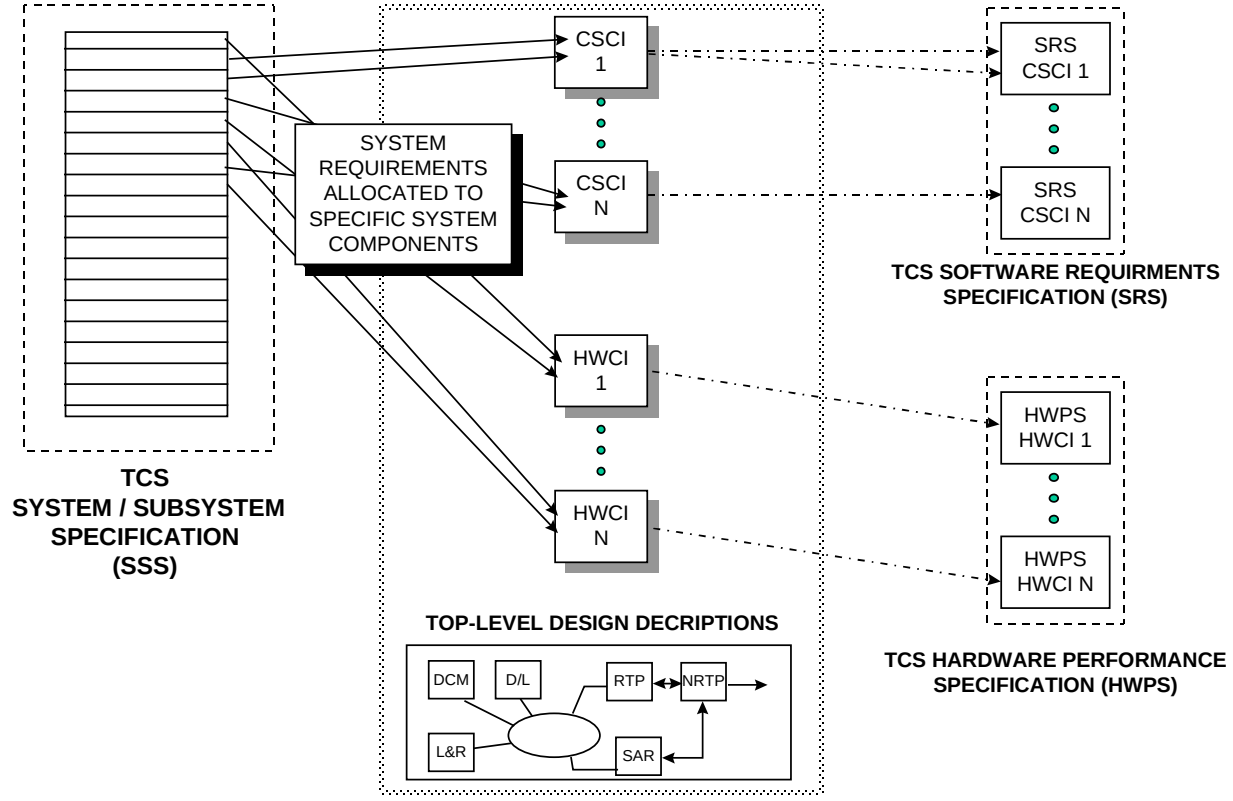

Figure 1.3-1 TCS System/Subsystem Design Document

For detailed information with respect to the SSDD layout and structure, refer to the Table of

Contents.

Chapter 2 Referenced Documents

2.1 Government Documents

Only documents that are directly referred to in this document are included in the document lists.

1. MIL-STD-2500A Military Standard National Imagery Transmission Format (Version 2.0), 18 June 1993.
2. MIL-STD-498 Software Development and Documentation, 5 Dec 94.
3. Operational Requirements Document for the Unmanned Aerial Vehicle Tactical Control System (Version 5.0)
4. TUAV ORD
5. Predator ORD
6. TCS CONOPS
7. Tactical Control System System/Subsystem Specification, Version 1.0, 30 June 1997
8. MIL STD 1472 HCI
9. MIL STD 882 Safety
10. UAV TCS Program Management Plan, Version 1, 19 February 1997
11. Joint Technical Architecture
12. Defense Information Infrastructure/Common Operatind Environment
13. Common Imager Ground/Surface System
14. USIGS

2.2 Non-Government Documents

(None)

Chapter 3 System Wide Design Decisions

3.1 Inputs and Outputs

The TCS shall have inputs from external sources as shown in Figure 3.1-1. (SSS009)[SSDD001]

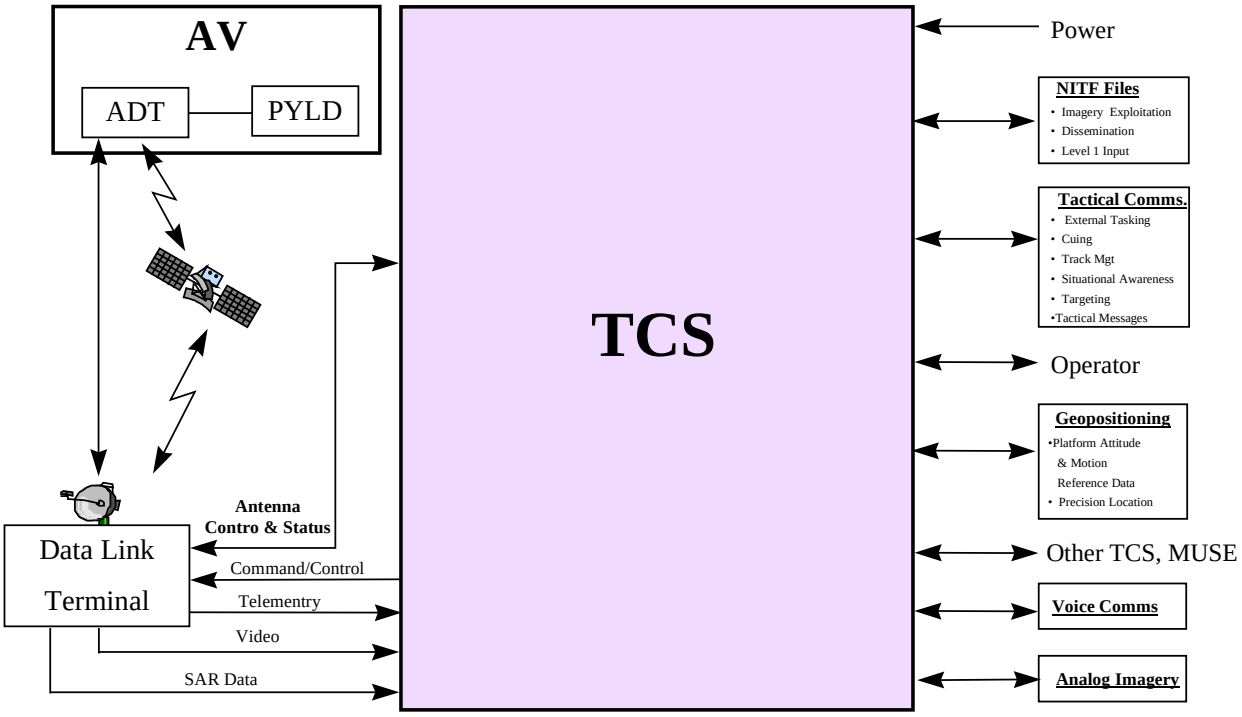

Figure 3.1-1 TCS Inputs and Outputs

3.2 System Behavior

The TCS Operator(s) will be able to control and monitor multiple AV(s) simultaneously, format, send, and receive tactical communication messages, control and monitor multiple payloads simultaneously, view and exploit payload data from multiple payloads simultaneously, send and receive voice communications, and send and receive analog video and NITF 2.0 digital imagery, record and retrieve payload data, plan UAV missions, and monitor the health and status of the TCS system.

The data latency for all TCS components shall not be greater than that present in the Predator ground control station or the Outrider ground control station whichever is smaller. (SSS409) [SSDD002]. The data latency for the Predator Ground Control System (GCS) is TBD. The data latency for the Outrider GCS is TBD.

After emplacement at the operational site, the TCS shall be capable of planning, and conduting a

mission within 1 hour of tasking. (SSS441) [SSDD003] Required activities include 1) mission planning of a minimum 1 waypoint mission, 2) preparing 2 AVs for flight, 3) datalink terminal set-up, 4) safety equipment emplaced, 5) and a single AV launched.

The TCS components shall be capable of operating continuously in the Operation Mode for a minimum of 72 hours. (SSS442) [SSDD004]

The TCS shall provide the capability to simultaneously view imagery as well as data from more than one payload, when applicable. (SSS537)[SSDD005]

3.2.1 System Actions

System actions will be determined and specified by the Operational Task and Analysis (OTA) Report, TCS 111.

The functional areas of the system actions consist of the following:

1. TCS System Control and Monitoring -
2. Mission Planning -
3. AV Systems Control and Monitoring -
4. Data Acquisition and Manipulation -
5. Target Coordination Development/Extraction -
6. Data Import/Export and C4I -

3.2.2 Response Times

The response time for the TCS shall be equal to or less than the response times of the Predator and Outrider GCSs (SSS)[SSDD006]. The response time the TCS is TBD.

3.2.3 Error Handling

Software error handling will be left to the software design and will be realized through the use of TBD.

Hardware error handling shall be realized and controlled through the use of Fault Detection/Location (F/DL).(SSS)[SSDD007]

Interface error handling shall be realized and controlled by the appropriate interface protocol method of the interface(SSS)[SSDD008].

3.3 Safety, Security, And Privacy

The TCS is an Automated Information System (AIS). Therefore, as per DoD Regulation 5000.2-R, dated March 15, 1996, the TCS shall meet security requirements in accordance with DoD Directive 5200.28(D), "Security Requirements for Automated Information Systems" dated March 21, 1988. (SSS361)[SSDD009]

The TCS shall be accredited by the Designated Approving Authority prior to processing classified as well as sensitive unclassified data. (SSS362)[SSDD010]

The TCS data sensitivities shall be determined by the data sensitivities of the systems with which it interfaces, to including the air vehicles, payloads, and C4I systems. (SSS364)[SSDD011]

Links that provide communications between the TCS and other systems shall be secured in a manner appropriate for the sensitivities of the material passed through such links, in accordance with DoD Directive C-5200.5, "Communication Security (COMSEC)" dated 21 April 1990. (SSS365)[SSDD012]

Risk levels and a program to manage the probability and severity of hazards shall also be developed. (SSS360)[SSDD013]

Using risk assessment procedures defined in DoD 5200.28(D), a risk index and the minimum security requirements for TCS shall be determined. (SSS363)[SSDD014] The inputs to this procedure are the clearance or authorization of the TCS users and the sensitivities of the data that the TCS processes, stores or transfers. These requirements pertain to the TCS computer hardware and software.

The TCS shall be designed such that no single software failure results in an unsafe command being transmitted to the air vehicle. (SSS353)[SSDD015]

The TCS shall be designed such that no single hardware failure results in an unsafe command being transmitted to the air vehicle. (SSS353)[SSDD016]

All hardware, software, documentation, and sensitive information processed by TCS shall be physically protected, minimally at the level determined by the risk index computed in Section 3.8.1, to prevent intentional as well as unintentional disclosure, destruction, and modification. (SSS367)[SSDD017]

The TCS shall be approved for operation at the same security classification level as the systems with which it interfaces. (SSS368)[SSDD018]

All TCS users, operators, maintainers and other personnel having access to TCS shall be cleared to the highest sensitivity of the data that the TCS processes, stores and transfers. (SSS369)[SSDD019]

Additional local site procedures shall be developed to prevent the intentional or unintentional disclosure of sensitive information to unauthorized individuals. (SSS370)[SSDD020]

A training program consisting of an initial security training and awareness briefing covering AIS security in general but also tailored to the TCS shall be developed. (SSS371)[SSDD021]

3.4 Design and Construction Choices

During Phase 1, design and construction will be accomplished in accordance with commercial best practices unless otherwise required to meet a specific service operational environmental factor. Design and construction requirements for Phase 2 will be revised to reflect appropriate government approved sub-tier specifications controlling all aspects of electrical and electronic or mechanical designs for new or modified TCS equipment.

Data Control Modules (DCM) will be supplied by the air vehicle manufacturers to allow for modulation/demodulation of the uplink/downlink signal to/from the air vehicles. The DCMs will be developed in accordance with the AV Standard Interface IDD to insure interoperability with TCS. All software resident within a particular DCM is the responsibility of the air vehicle manufacturer and is not a TCS software configuration item.

The TCS will provide additional support equipment (VME Computer Assembly) required for real-time processing to include imagery processing, antenna control commands, payload commands, and launch and recovery.

Individual Datalink Terminals will be supplied by the AV manufacturers for use by TCS. Future incorporation of the Tactical Common Data Link (TCDL) will include a programmable antenna that will eliminate the need for air vehicle specific Datalink Terminals.

The TCS will incorporate a Local Area Network (LAN) architecture that include a high and low speed LAN and a high speed imagery LAN.

The TCS design shall consider all safety requirements affecting design and performance except nuclear safety. [SSS345][SSDD022]

The TCS shall comply with para 5.3 of MIL-STD 882C, "System Safety Program Requirements", dated 19 January 1993 w/ Notice 1 dated 19 January 1996. [SSS346][SSDD023]

The TCS design shall provide protection against injury to TCS operators and maintenance personnel. [SSS357][SSDD024]

The TCS system design shall use MIL-STD-2036, Section 5.1.3.11 as a guide, with regard to personnel hazards, and MIL-STD-1472D, Section 5.13, as a guide for safety from a human engineering viewpoint. [SSS358][SSDD025]

System safety and health hazards, if any, shall be identified and evaluated during Phase I of the TCS development. [SSS359][SSDD026]

Risk levels and a program to manage the probability and severity of hazards shall also be developed. [SSS360][SSDD027]

The TCS shall be designed to minimize the number and frequency of required preventive maintenance actions based on performance requirements and lowest life cycle costs. (SSS412) [SSDD028]

The TCS shall minimize the contribution to degradation of TCS equipment reliability as a consequence of performing either preventive as well as corrective maintenance. (SSS412) [SSDD029]

The TCS shall enable the performance of all maintenance actions with safety and comparative ease by providing adequate access to all equipment components and minimizing the requirements for special tools and test equipment. (SSS412) [SSDD030]

To the extent possible, the TCS design shall minimize the requirement for specially trained maintenance personnel. (SSS412) [SSDD031]

In addition to FD/L, TCS design shall improve system availability by the effective selection and incorporation of Built In Test Equipment (BITE). (SSS412) [SSDD032]

The TCS shall be designed in a manner that will allow for removal and replacement of replaceable units without soldering and unsoldering. (SSS412) [SSDD033]

The TCS equipment shall achieve an availability (A_o), as defined by the below equation. (SSS413) [SSDD034]

$A_o = (OT + ST)/(OT + ST + TPM + TCM + TALDT)$

where: OT denotes Operate Time
ST denotes Standby Time
TPM denotes Total Preventative Maintenance
TCM denotes Total Corrective Maintenance
TALDT denotes Total Administrative and Logistic Downtime

The threshold Ao for the TCS shall be greater than or equal to 90% in order to maintain a continuous 24 hour presence (SSS413) [SSDD035], with an objective Ao of 95%. (SSS413) [SSDD036]

The TPM on a non interference basis shall not exceed 1 hour per day. (SSS413) [SSDD037] Preventative Maintenance (PM) on an interference basis shall be acceptable, but shall not exceed 1 hour per week. (SSS413) [SSDD038]

The TCS shall achieve a threshold system reliability (Mean Time Between Failures MTBF) equal to or greater than 2000 hours (SSS410) [SSDD039], with an objective system reliability of 3000 hours. (SSS410) [SSDD040]

The TCS maintainability will be considered in every phase of the design and development process. The TCS threshold maintainability (Mean Time To Repair (MTTR)) shall be equal to or less than 1.9 hours (SSS411) [SSDD041], with an objective maintainability that shall be equal to or less than 1 hour (SSS411) [SSDD042].

The total, fully useable, addressable, physically present program instruction memory and data storage memory for each processor shall have at least 50% unused memory during the Normal Operations Mode over any 10 second period. (SSS414) [SSDD043]

The processing speed of each processor shall be such that at least 50% of the throughput of each processor remains unused over all 10 second periods and at least 20% of the throughput of each processor remains unused over one second periods regardless of the system function performed. (SSS415) [SSDD044]

The I/O channel reserve capability for each processor shall have at least a 50% reserve, addressable and useable, I/O channel capacity over any 10 second period. (SSS416) [SSDD045]

All hardware components (developed or selected to be used in the TCS design) , to the extent possible, shall support the concepts of modularity, scaleability, and future growth. (SSS418) [SSDD046] Actual physical characteristics of the various hardware components will vary dependent on implementation details and will be determined during Phase 1 Program Definition and Risk Reduction of TCS.

The hardware components used in the TCS design shall provide the flexibility to host various software packages (developed or selected) that are used by the TCS. (SSS418) [SSDD047] The software components used in the TCS design, to the extent possible, will be host hardware independent and portable to all TCS Workstation HWCIs.

The selection of TCS HWCIs to include processors, interface cards for communication interfaces, disk drives, video, networking equipment, and all other hardware for use in the TCS shall be made according to standards for production of an open architecture. (SSS419) [SSDD048]

Testability shall be considered in the design and development of the TCS. components. (SSS421) [SSDD049]

Control over TCS components (HWCIs and CSCIs) shall be provided for detecting and isolating internal faults. (SSS423) [SSDD050]

Test points and data paths shall be defined to support efficient fault isolation. (SSS424) [SSDD051]

During Phase 1, control techniques to minimize electromagnetic interference, emanation, and susceptibility shall be used in the design of TCS equipment. (SSS432) [SSDD052] This control will be inherent in the design of the TCS and the electrical and electronic equipment components and assemblies thereof.

There shall be neither unacceptable response nor malfunction of any TCS and associated equipment due to EMI produced by any as well as all of the TCS and equipment associated with the TCS. (SSS434) [SSDD053]

The TCS shall be compatible with the external electromagnetic environment that is typical of the service specific environment in the TCS will be operated. (SSS435) [SSDDD054] The specific electromagnetic environment values will be determined during Phase I of the TCS development.

The TCS design shall ensure that personnel, fuel, and ordinance are not exposed to electromagnetic radiation as a result of operating the TCS. (SSS436) [SSDD055] The specific radiation hazard (RADHAZ) and HERO values will be determined during Phase I of the TCS development.

The TCS shall be designed to protect its communication and data links against enemy Electronic Warfare (EW) threats, physical anti-radiation weaponry and physical destruction. (SSS366)[SSDD056]

The TCS shall have ergonomically designed operator controls and displays for the 5th percentile female to 95th percentile male operator. (SSS443) [SSDD057]

See Appendices A and B of this document for configuration specific design and construction choices made of the TCS-LS and TCS-SB configurations.

3.5 Logistics Related Requirements

The Subsystems shall be supported by the services' standard logistic system. Logistic support requirements shall be determined by the LSA process which will influence system development and support. LSA shall be performed on all equipment on which no previous analyses have been made. The logistics analysis process shall be accomplished IAW MIL-STD-1388-1 tailored to fit program requirements. The resulting data, when applicable, shall be recorded in the Logistics Support Analysis Record (LSAR) IAW MIL-STD-1388-2. The LSA program shall be the single analytical effort to evaluate design alternatives, to determine the most cost efficient methods of providing logistics support, and to acquire data required to provide integrated logistics support. Operator, unit maintainer, and intermediate maintenance tasks identified in the LSA/LSAR process shall be addressed in the training documentation. Logistics specifications are further defined in the ILSDS.

Support for the TCS shall be in accordance with the Integrated Logistical Support Plan (ILSP) and the maintenance concepts and policies of the individual Services. (SSS504) [SSDD058]

All TCS Operator Manuals and Technical Manuals shall be verified and validated prior to initial operational test. (SSS529) [SSDD059]

TCS transport and storage containers shall be reusable and enable the operators to set-up equipment within the established timelines in their ORDs. (SSS505) [SSDD060]

The TCS shall adhere to DOD regulations and policy governing military standards for logistics, Petroleum, Oil and Lubricants (POL), tools, Test, Measurement, and Diagnostic Equipment (TMDE), tools, and other support items. (SSS506) [SSDDO61]

Standard tools, TMDE, repair parts, and lubricants shall be used to maintain the TCS. Exceptions shall be considered on a case by case basis. (SSS507) [SSDD062]

Each Service shall support the TCS as part of the UAV system which is organic to them. (SSS508) [SSDD063]

The TCS shall be maintained in accordance with the UAV ORD for that Service and the Level Of Repair Analysis (LORA) for the hardware chosen. (SSS509) [SSDD064]

A TCS support and fielding package shall be developed and available for operational testing. (SSS510) [SSDD065]

The TCS shall be maintained in accordance with Services' approved UAV maintenance concepts and procedures. (SSS511) [SSDD066]

To the maximum extent possible, general purpose test equipment (GPTE) and common tools resident in each service shall be used to perform all corrective and preventative maintenance at all authorized levels of maintenance. (SSS512) [SSDD067]

Tools and test equipment required to maintain the TCS but not resident in each service inventory shall be identified as special tools and special purpose test equipment (SPTE), respectively, and kept to a minimum. (SSS513) [SSDD068]

The environmental support required by the TCS shall be the same as that required for the respective UAV System. (SSS514) [SSDD069]

Basing for the system shall follow the plan for UAV units and service command echelon requirements as delineated in the ORD. (SSS515) [SSDD070]

3.6 TCS Design Documents

System requirement and interface documentation shall be developed as part of the TCS program and will follow MIL-STD-498 for format. (SSS427) [SSDD071] Technical and Operator Manuals will follow the Technical Manual Contract Requirements (TMCR).

The documentation developed shall contain sufficient level of detail to identify the functional, operational and design requirements of the TCS. (SSS428) [SSDD072]

The documentation shall contain sufficient technical detail to define the hardware and software design implemented to satisfy the system requirements. (SSS429) [SSDD073]

The TCS documentation shall include: (SSS430) [SSDD074]

1) The TCS System/Subsystem Specification (SSS)
2) The TCS System/Subsystem Design Document (SSDD)
3) The TCS Software Requirements Specification (SRS) (1 for each CSCI)
4) The Software Design Document (SDD) (1 for each CSCI)
5) The TCS Hardware Design Document (HDD)
6) Interface Design Document (IDD) for all interfaces
7) TCS Version Description Document(s) (VDD)

4 System Architectural Design

The TCS operational architecture will be in accordance with the TCS Concept of Operations (CONOPS). The TCS technical architecture will follow and comply with the Joint Technical Architecture, Common Imagery Ground/Surface System (CIG/SS), and the Defense Information Infrastructure/ Common Operating Environment (DII/COE). The physical system architecture will

utilize and implement is as depicted in the block diagram Figure 4.0-1 TCS System Arhitecture.

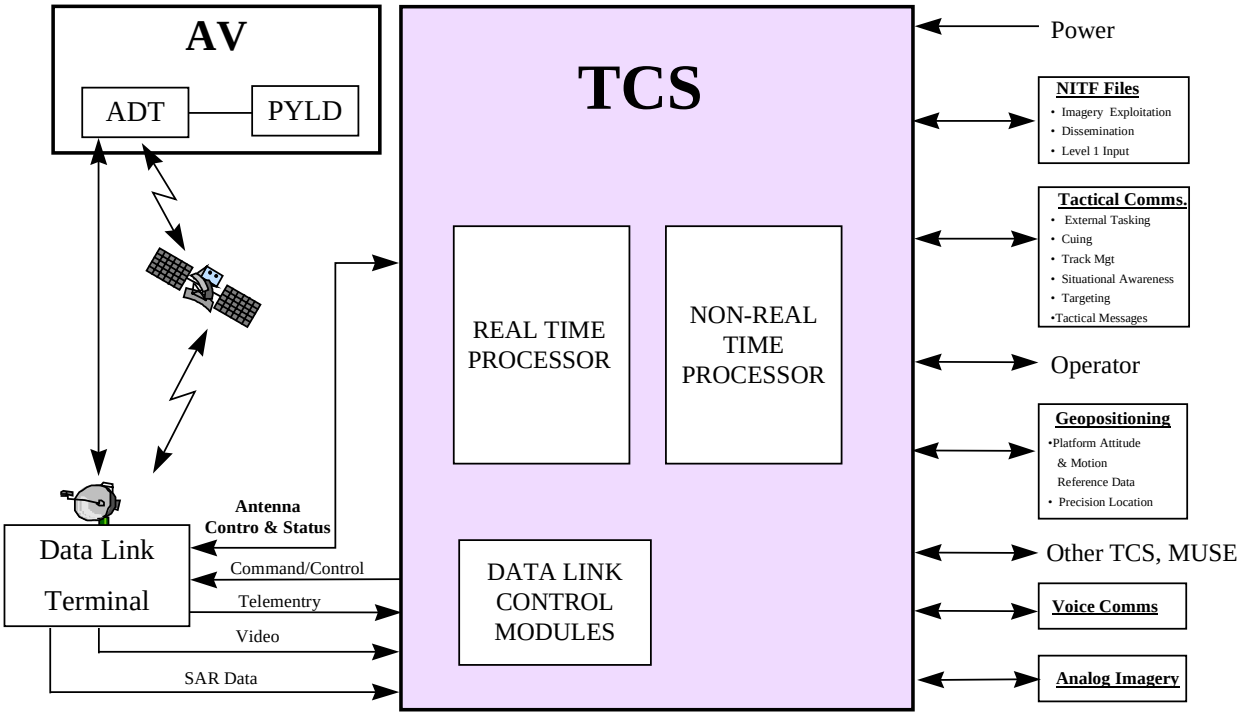

Figure 4.0-1 TCS System Architecture

The TCS will be functionally and physically partitioned into hardware and software components, Hardware Configuration Items (HWCIs) and Computer Software Configuration Items (CSCIs), to provide an open architecture that allows for efficient fault isolation.

The CSCI and HWCI allocations have been made in accordance with the following design considerations:

1. Be fully compatible with the TCS ORD and SSS as well as the unique requirements levied by the UAV Program, legacy or new development that TCS will integrate with.

2. Be compliant with JTA, CIGS/SS and utilize DII/COE to the maximum extent practical.

3. Maximize the commonality of TCS hardware and software utilized to support multiple types of AV platforms.

4. Maximize the commonality of TCS hardware and software utilized to support different Payloads.

5. Minimize the amount of hardware and software considered Flight Critical.

6. Minimize the effect AV modifications will have to the TCS.

7. Minimize the effect Payload modifications and upgrades have on the TCS.

8. Minimize the effort to integrate the control of additional AV types.

9. Minimize the effort to integrate the control of additional Payload types.

10. Minimize the impact of C4I system upgrades and modifications on TCS.

11. Minimize the coupling of Mission Planning capability with other capabilities to facilitate a separate procurement.

12. Maximize commonality between TCS variant configurations (e.g., TCS-SB, TCS-LS).

The TCS shall be partitioned into the following CSCIs: DII/COE-Operating System, TCS Core Functionality, TCS Data Server (DS), TCS Mission Planner, Real Time Processor (RTP), Synthetic Aperture Radar (SAR), User Interface Manager (UIM), and C4I Interfaces. (SSS422) [SSDD075]

The TCS shall be partitioned into the following HWCIs: TCS Computer, Datalink Control Modules, Common Automated Recovery System (CARS), Integrated Beacon Landing System (IBLS), External Storage, Printer(s), Datalink Terminal(s), Antenna Assembly, Versa Module Eurocard (VME) Computer Assembly, SAR Processor, Linear Digital Tape Drive, VCR, Video Support, and C4I Support Equipment. [SSS422] [SSDD076]

The TCS shall transmit command and control information to the AV via the uplink to the AV (SSS110) [SSDD077], and receive AV telemetry and payload information via downlink from the AV (SSS111) [SSDD078].

The TCS shall be capable of interfacing with the specified datalink terminal and issuing data link terminal commands required to establish, control, and maintain the data link with a selected AV. (SSS159)[SSDD079]

4.1 System Components

The TCS system components will be defined and consist of the HWCIs and CSCIs as identified in this doucment. Components do not equate to subsystems of TCS.

The TCS will consist of the following subsystems: Antenna, Data Link, Real Time Processor, Non Real Time Processor, Launch and Recovery, Data Link Control Modules, Imagery, SAR, Communications, and Power Distribution. Figure 4.1-1 TCS System/Subsystem Hierarchy Diagram. shows the various subsystems of the system.

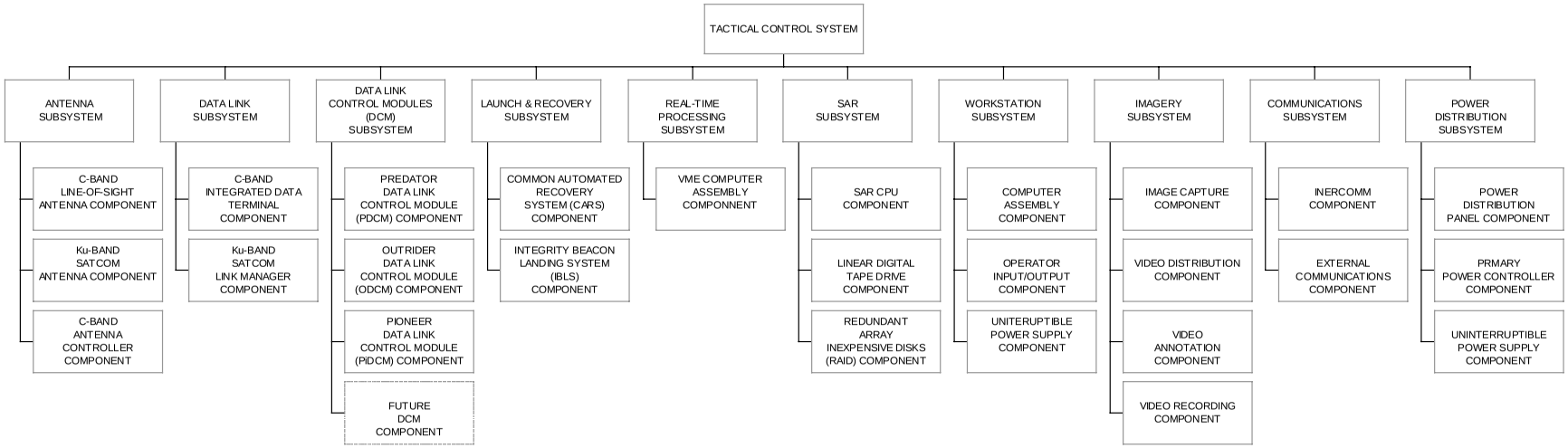

Figure 4.1-1 TCS System/Subsystem Hierarchy Diagram

The TCS hardware will consist of a workstation and other specific hardware (e.g. video matrix, amplifiers, converters, VCR, monitors, etc.) necessary to support operations.

The workstations shall be service specific hardware, and will consist of SUN SPARC (CHS-II), Hewlett Packard TAC-4, and Silicon Graphics (SGI) workstations. (SSS398)[SSDD080]

The TCS workstation for the Army and Marine applications shall be the SUN SPARC 20, TBD. (SSS398)[SSDD081]

The TCS workstation for the Navy applications shall be the TAC-4, HP 9000 model 712.J210 series. (SSS398)[SSDD082]

The TCS workstation for the Air Force will consist of hardware produced and supplied by Silicon Graphics. (SSS398)[SSDD083]

Table 4.1-1 Allocation of TCS Computer's Resources to TCS CSCIs and Operating System identifies the percentage allocation of the computer resources to the CSCIs that comprise TCS.

Table 4.1-1 Allocation of TCS Computer's Resources to TCS CSCIs and Operating System

CSCI/Category	Throughput	RAM	Hard Disk
DII/COE/Operating System	5%	10%	8%
TCS Core Functionality	10%	10%	10%
TCS Data Server	10%	7%	10%
C4I Interfaces	6%	5%	4%
TCS Mission Planner	7%	6%	7%
Antenna Controller	2%	2%	1%
SAR	N/A	N/A	N/A
UIM			
Management Reserve	10%	10%	10%
Growth	50%	50%	50%

* Management Reserve maybe allocated at the Phase I CDR and TRR as well as Phase II CDR and TRR.
* For the objective system growth allocation shall be 75%. Therefore the allocation for each CSCI/Category will be modified consistent with the enhanced hardware and software changes.

Figure 4.1-1 TCS Phyisical Hardware Architecture provides a detailed block diagram of the overall system physical hardware architecture.

Figure 4.1-2 TCS Imagery and Information Flow Diagram provides a notional depiction of the information flow paths between the TCS components.

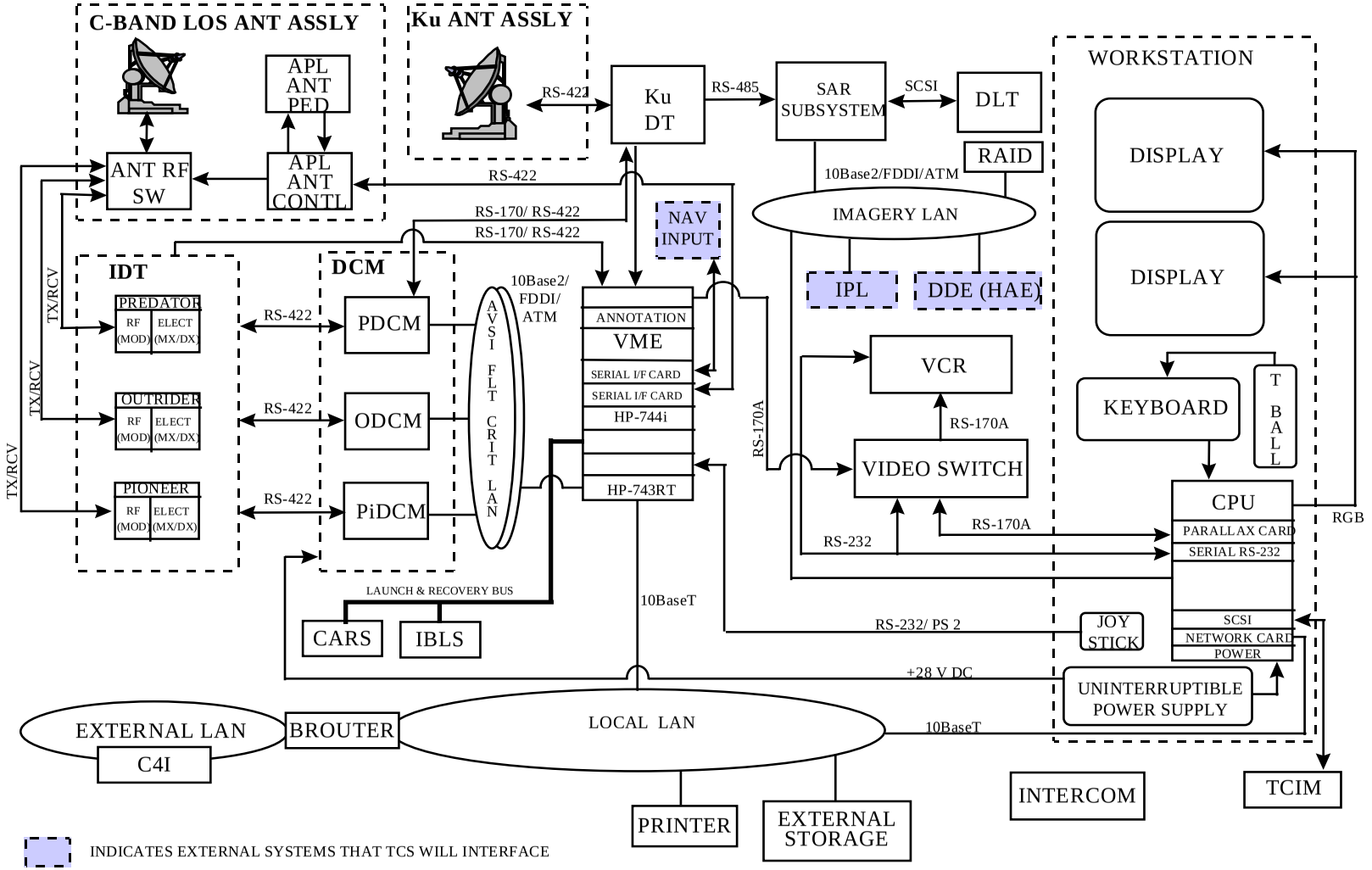

Figure 4.1-1 TCS Physical Hardware Architecture

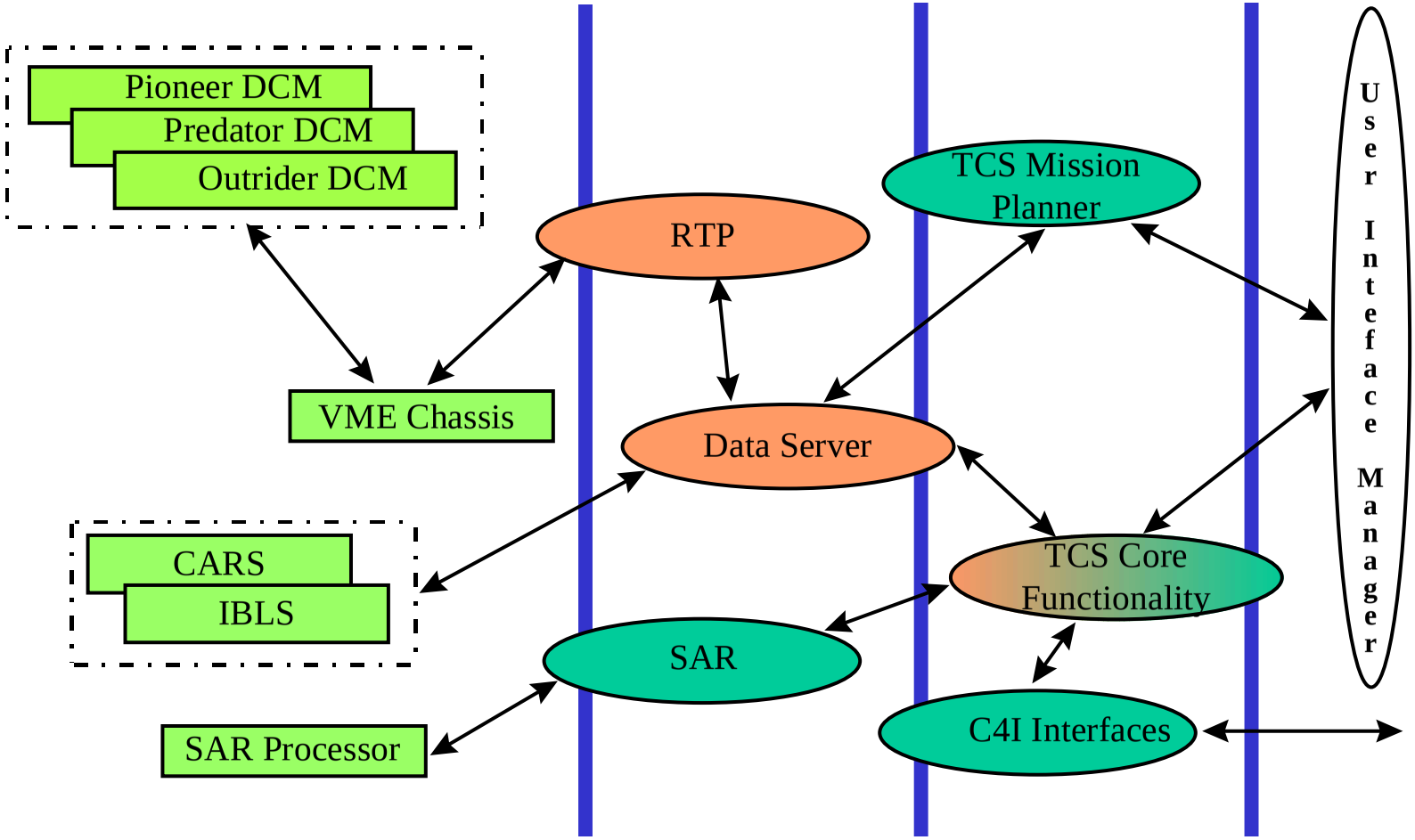

Figure 4.1-2 TCS Imagery and Information Flow Diagram

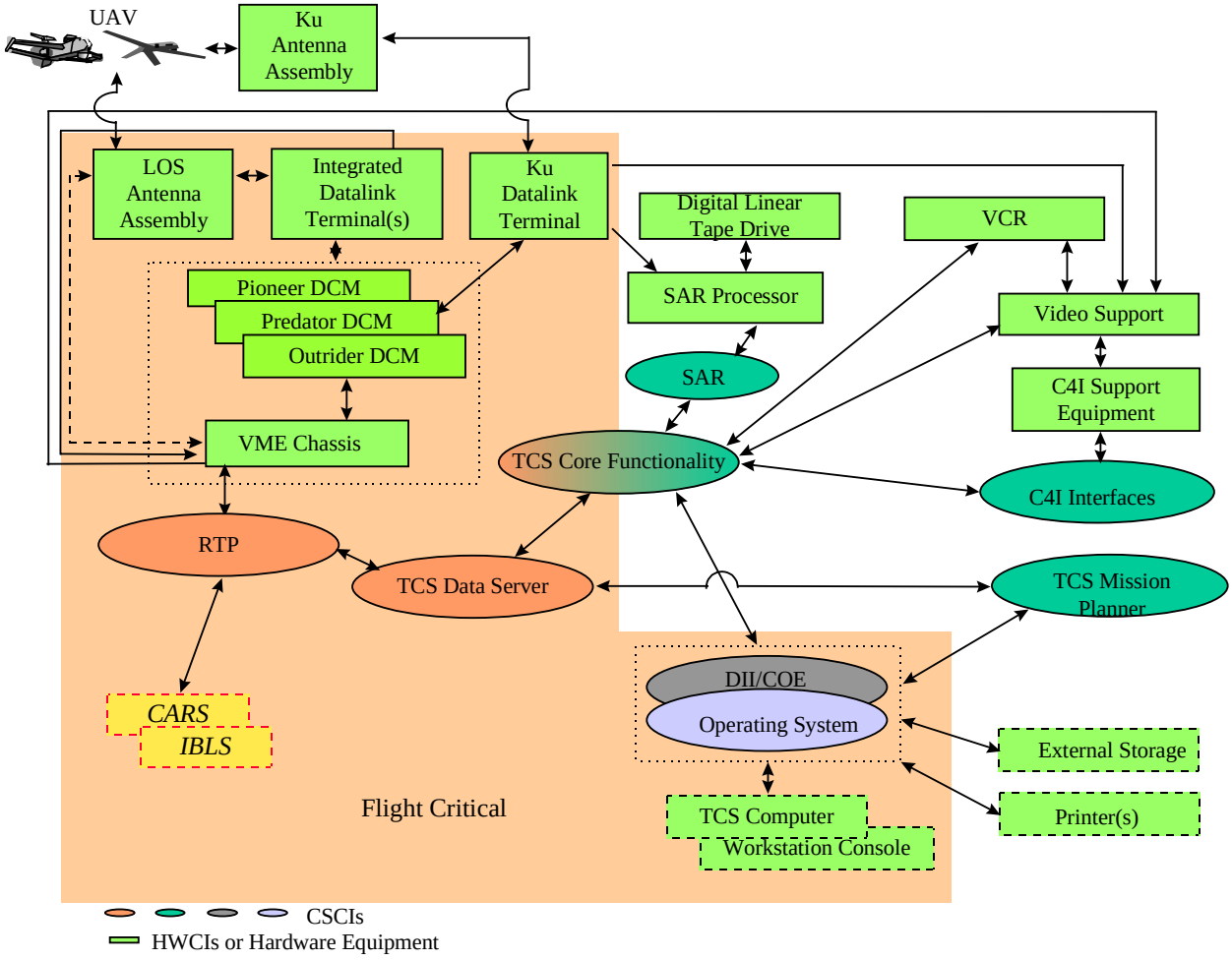

Figure 4.1-3 TCS Component Architecture

As shown in Figure 4.1-3 TCS Component Architecture, the TCS components shall consist of the following: TCS Computer HWCI, Video Support HWCI, SAR Processor HWCI, Datalink Control Module HWCI(s), VCR HWCI, Linear Digital Tape Drive HWCI, TCS Printer, RTP CSCI, TCS Data Server CSCI, TCS Core Functionality CSCI, DII/COE-Operating System CSCI, TCS Mission Planner CSCI, SAR CSCI, and the C4I Interface CSCI. (SSS004) [SSDD084]

The TCS shall also contain a configuration specific Uninterruptible Power Supply HWCI. (SSS004) [SSDD085] The TCS may contain a configuration specific Workstation Console HWCI.

The TCS support equipment shall include the following: C4I Support Equipment HWCI, C4I Communication Equipment HWCI, Intercom Equipment HWCI, External Storage HWCI, External Printer HWCI, Datalink Terminal HWCIs, the CARS HWCI, and the IBLS HWCI. (SSS004) [SSDD086]

The TCS shall utilize operating systems and programming languages that are DII/COE compliant

and support an open architecture environment. (SSS420) [SSDD087]

The TCS components shall conform with the National Institute for Standard Technology (NIST) Federal Information Processing Standard (FIPS) Publication 151-2(POSIX.1). (SSS381) [SSDD088]

For each Outrider system, the TCS components shall provide full independent computer redundancy. (SSS380) [SSDD089]

The TCS software shall be developed using UNIX as the operating system. (SSS420) [SSDD090]

For the windowing environment TCS shall use X-windows (SSS447) [SSDD091], and Graphical User Interface (GUI) application development shall use Motif. (SSS447) [SSDD092]

The TCS software development language shall be primarily Ada95, but specific application functionality may be developed using ANSI C. (SSS420) [SSDD093]

The use of machine dependent assembly languages shall be minimized to only those interfaces where direct machine control is required. (SSS420) [SSDD094]

4.1.1 TCS Hardware Configuration Items (HWCI)

In the selection of HWCIs to satisfy the requirements herein, Non-Developmental Items (NDI) (off-the-shelf equipment previously approved for service use) shall be chosen to the maximum practicable extent. (SSS426) [SSDD095] If NDI that provides the desired functions can not be identified, then Commercial-Off-The-Shelf (COTS) hardware shall be used. (SSS426) [SSDD096]

The HWCIs of the TCS shall be capable of being scaled as well as being modular to meet the varying needs of the Services. (SSS374) [SSDD097]

The TCS HWCIs shall be mounted as well as ruggedized to withstand inter and intra theater movement. (SSS373) [SSDD098]

The TCS HWCIs shall allow the air vehicle and payload operators to perform mission control, mission monitoring, and mission updates and modifications while wearing cold weather clothing and in a Mission Oriented Protective Posture. (SSS444) [SSDD099]

4.1.1.1 TCS Computer HWCI

The purpose of the TCS Computer HWCI is to provide the Central Processing Unit (CPU) that will allow TCS to perform all required TCS functionality to include: Mission Planning, Mission Control and Monitoring, Payload Processing, Targeting, and C4I Interfacing.

The TCS Computer HWCI will have the minimum characteristics as described in Table 4.1.1.1-1.

Table 4.1.1.1-1 Minimum TCS Computer Characteristics

Computer Characteristic	TAC-4	SPARC 20
CPU Processor	120 MHZ PA-RISC 7200	Dual 150 MHz
RAM	320 MB	256 MB
CPU Throughput	TBD	TBD
Hard Disk (Internal)	2 GB Fast Wide SCSI 1 GB Fast Wide SCCI	2 GB
Hard Disk (Removeable)	2 GB Single Ended SCSI 2 GB Single Ended SCSI	
Monitor	Dual 19”	Dual 20”
CD-ROM		
Tape Drive	4 mm	4 mm
Graphics Card	HP specific 2D	SX
Video Capture	Paralax	Paralax
Additional Processor Cards	FDDI/Ethernet	FDDI
Interfaces	AUI LAN Interface External SCSI	AUI LAN Interface External SCSI
Ports	RS-232C Parallel Printer	A&B Serial

The TCS Computer HWCI shall be capable of storing a minimum of 500 mission plans under unique names to allow for later retrieval. (SSS058)[SSDD100]

The TCS Computer HWCI shall allow access to other computers via network interfaces to share in processing capability. (SSS377) [SSDD101]

The TCS Computer HWCI shall allow for multiple external peripherals including printers and scanners. (SSS378) [SSDD102]

The TCS Computer HWCI shall have a read and write CD drive for storage and retrieval of TCS data. (SSS341)[SSDD103]

The TCS Computer HWCI shall provide a tape drive for storage and retrieval of TCS data. (SSS342)[SSDD104]

The TCS Computer HWCI shall provide a RAID for storage and retrieval of TCS data. (SSS343)[SSDD105]

To meet the growth requirements the TCS Computer HWCI shall be capable of adding additional storage media such as tape, disk, and CD drive, without major hardware reconfiguration. (SSS383)

[SSDD106]

The TCS Computer HWCI shall be able to read data from National Imagery and Mapping Agency (NIMA), CD-ROM Digital Terrain Elevation Data (DTED), Digital Feature Analysis Data (DFAD), and embedded training media available on CD-ROM media. (SSS384) [SSDD107]

The TCS Computer HWCI throughput shall not exceed 50% of the throughput capability delivered over any 10 second period. (SSS389) [SSDD108]

The TCS Computer HWCI shall be capable of providing, as an objective, 25% of throughput capability delivered over any 10 second period. (SSS390) [SSDD109]

The TCS Computer HWCI shall be capable of providing a 50% spare memory storage capacity over delivered storage used. (SSS391) [SSDD110]

The TCS Computer HWCI shall be capable of providing a 75% spare memory storage capacity over storage used. (SSS392) [SSDD111]

The TCS Computer HWCI shall have the capability to import as well as create and modify map display overlays for fire support coordination measures(SSS547) [SSDD112]

4.1.1.2 Video Support HWCI

The purpose of the Video Support HWCI is to provide the capability to receive, amplify, convert, annotate, display, and distribute analog video. In addition, the Video Support HWCI provides the capability to capture freeze frames of the analog video and store, retrieve, and display the freeze frames.. The Video Support HWCI will be procured as a Commercial Off-the-Shelf Item (COTS) item. Figure 4.1.1.2-1 Video Support HWCI Interconnectivity Diagram identifies the elements of the component and shows the associated interconnectivity.

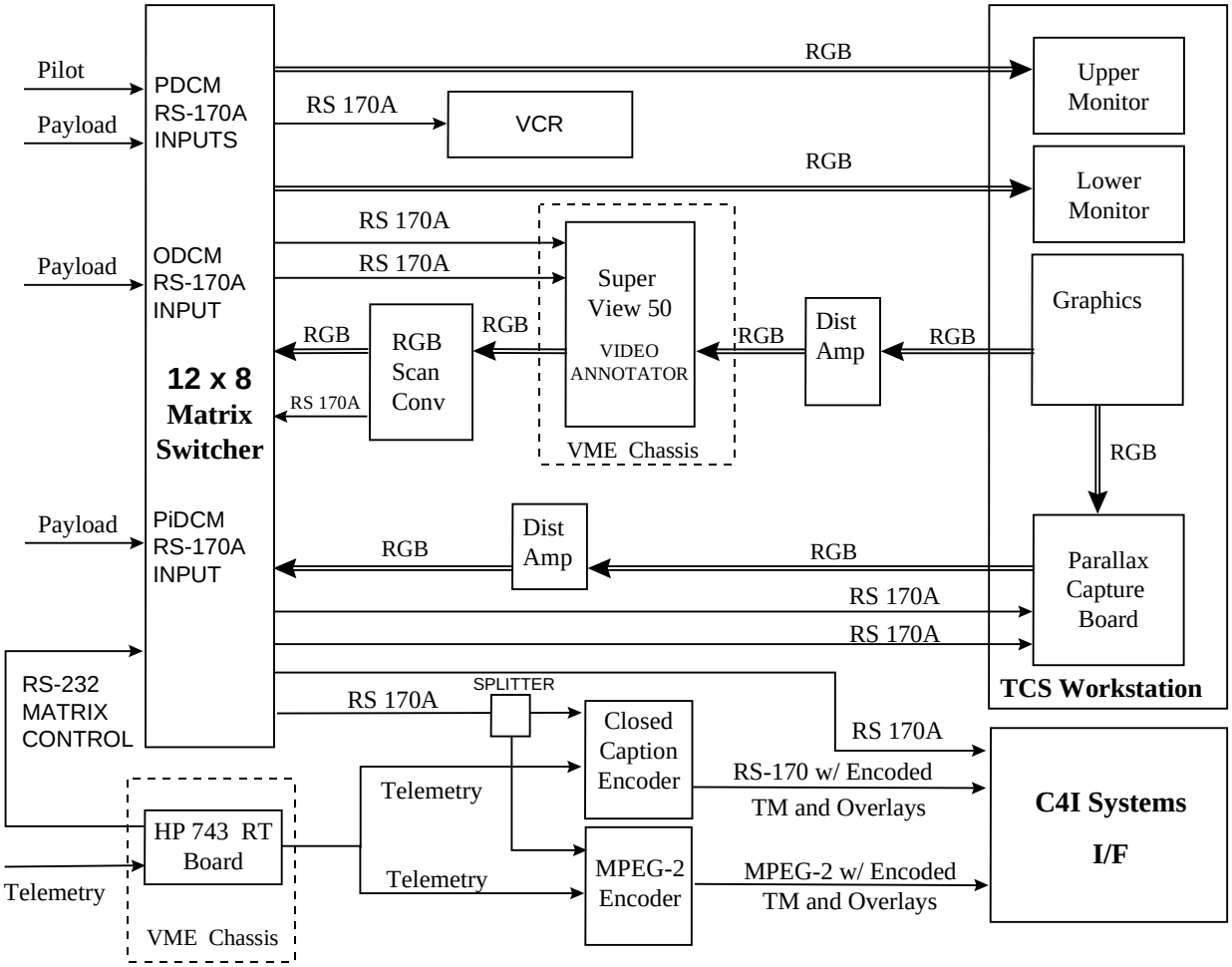

Figure 4.1.1.2-1 Video Support HWCI Interconnectivity Diagram

As a minimum, overlays will consist of information obtained from external sources that is selected by the operator for presentation with the imagery (e.g., date/time group, target location coordinates when the target is in the center of the field of view, north seeking arrow, and AV position and heading). As a minimum, annotation will include operator generated comments or graphics which are superimposed on the imagery.

The TCS Video Support HWCI shall be able to overlay the video imagery with overlays to include, as a minimum, date/time group, target location coordinates when the target is in the center of the field of view, north seeking arrow, and AV position and heading. (SSS203)[SSDD113]

The Video Support HWCI shall provide the hardware capacity to convert Payload imagery as necessary so it is in compliance with Common Imagery Ground Surface Station (CIGSS), United States Imagery Standards (USIS), National Imagery Transmission Format (NITF) Version 2.0 and Global Command Control Systems (GCCS).(SSS) [SSDD114]

The NITF 2.0 imagery files generated by the Video Support HWCI shall contain the necessary telemetry and support data to permit subsequent imagery exploitation by C4I systems. (SSS) [SSDD115]

Video Support shall send TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L) if supported by the HWCI. (SSS036) [SSDD116]

The TCS shall export and disseminate formatted NITF 2.0 files(SSS558) [SSDD117]

4.1.1.3 TCS SAR Processor HWCI

The purpose of the TCS SAR Processor HWCI is to provide front end processing of raw SAR data to include telemetry and imagery for input into the TCS Computer HWCI. See figure 4.1.1.3-1 TCS SAR Processor HWCI Diagram its connectivity with other TCS HWCIs

The TCS SAR Processor shall send TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L). (SSS036) [SSDD118]

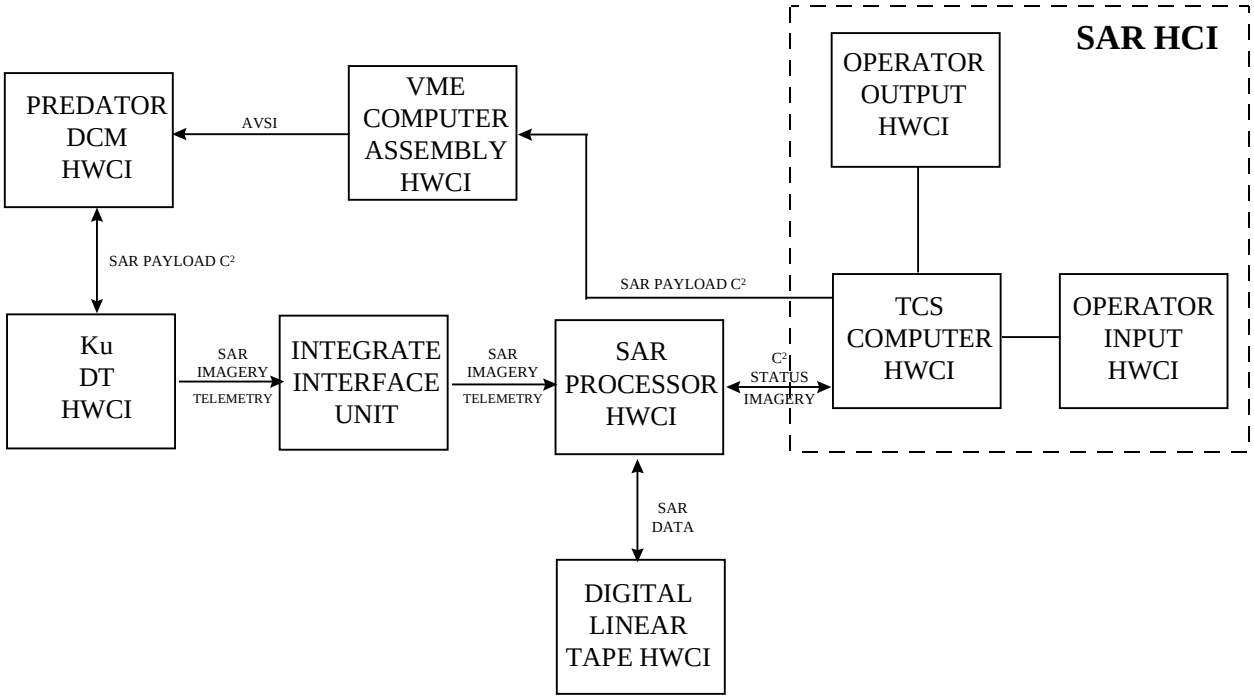

Figure 4.1.1.3-1 SAR Processor HWCI Configuration

4.1.1.4 Datalink Terminal HWCIs

The purpose of the Datalink Terminal HWCIs is to provide the data interface between the TCS and AV(s). These HWCIs will support communication with the AV ADT in order to accomplish launch/recovery, flight of the AV, and control of the AV payload(s). The Datalink Terminal HWCIs will

consist of the Integrated Datalink Terminal and SATCOM Datalink Terminal. The Integrated Datalink Terminal will provide a C-Band (4.5 to 6.85 Ghz) LOS communication capability with the Predator, Outrider, and Pioneer Air Vehicles. The Ku Datalink Terminal will provide Ku-Band (12.5 to 18.5 GHz) capability with Ku-Band capable Air Vehicles

TCS Datalink Terminal HWCIs shall support a concurrent uplink and downlink capability. (SSS325)[SSDD119] Figure 4.1.1.4-1 TCS C-Band Frequency Ranges shows the frequency ranges for specific AVs.

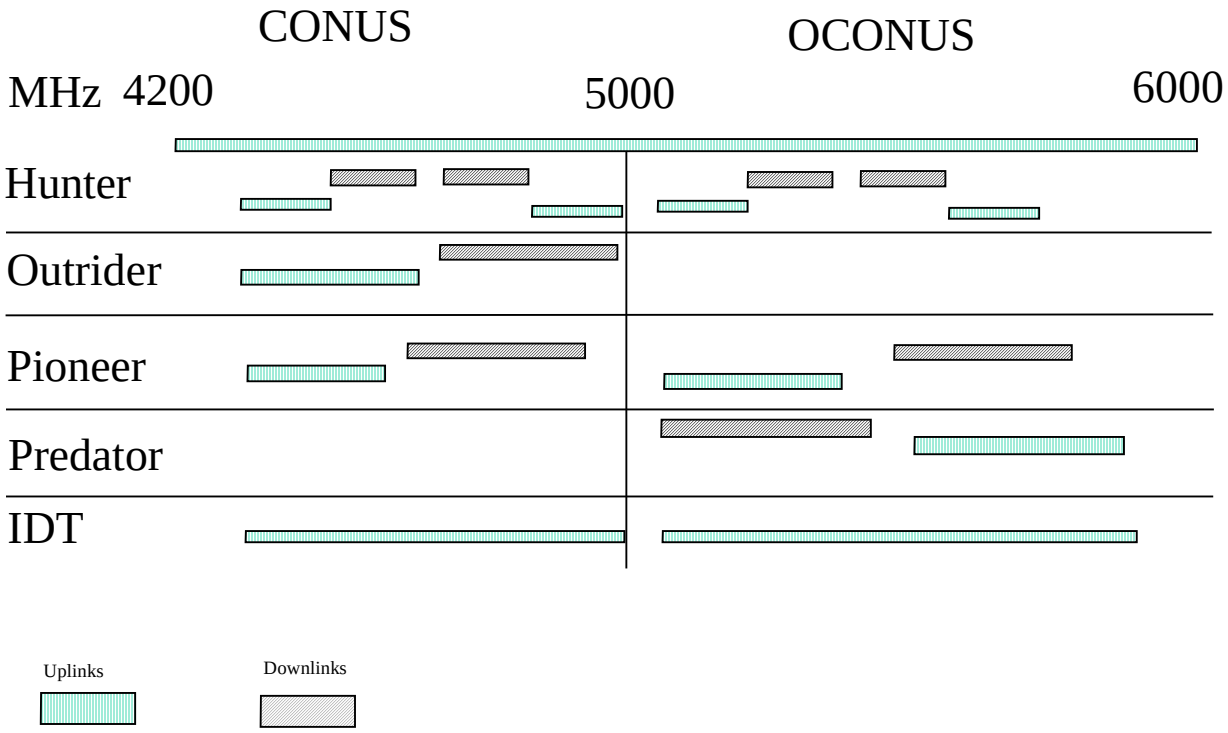

Figure 4.1.14-1 TCS C-Band Frequency

The TCS Datalink Terminal HWCIs shall support the data rate characteristics of the specific AV, data link, and payload to ensure interoperability with all Tactical UAV and HAE mission configurations. (SSS379) [SSDD120] Table 4.1.1.4-1 TCS Data Rate Characteristics shows the data rate characteristics currently supported by the identified tactical AVs and their associated data links.

Table 4.1.1.4-1 TCS Data Rate Characteristics

UAV	Function	Uplink(MHz)	Modulation	Downlink(MHz)	SubCarrier	Modulation
Hunter						
	LOS					
		4415-4478	FSK	4755-4920	5.5 MHz	NTSC/FSK
		4920-4985	FSK	4480-4645	5.5 MHz	NTSC/FSK
		5255-5278	FSK	5555-5720	5.5 MHz	NTSC/FSK
		5720-5785	FSK	5280-5445	5.5 MHz	NTSC/FSK
Outrider						
	LOS					
		4400-4625	FSK	4775-5000	7.5 MHz	NTSC/FSK
Pioneer						
	LOS					
		420-450	FSK	None	None	None
		4450-4570	BPSK	4750-4950	7.5 MHz	NTSC/FM
		5252-5450	BPSK	5650-5850	7.5 MHz	NTSC/FM
Predator						
	LOS					
		5625-5850	FSK	5250-5.475	6.8 Mhz	NTSC/FM
	SATCOM					
		11450-11950	OQPSK	14000-14500	None	OQPSK
		251.95-269.95	BPSK & OQPSK	292.95-310.95	None	BPSK & OQPSK

The TCS Datalink Terminal HWCIs shall have sufficient throughput to support the processing requirements of the selected data link. (SSS382) [SSDD121]

The TCS shall incorporate antenna pedestal 3 -axis stabilization to compensate for platform (e.g. ship, or HMMWV) motion, if applicable.(SSS557) [SSDD122

The Datalink Terminal HWCIs shall be initialized upon operator selection of a specific AV for use in ground based closed loop command and control functions. (SSS109)[SSDD123]

The Datalink Terminal HWCIs shall provide for air vehicle flight control beyond line of sight via uplink command for a minimum of two air vehicles of the same type using sequential communication techniques. (SSS125)[SSDD124] Sequential communication means alternatively communicating with one air vehicle and then the other. Current air vehicle design does not permit concurrent communications with two air vehicles at the same time.

Data terminal control shall include, but is not limited to transmitter and receiver control. (SSS160)[SSDD125]

4.1.1.4.1 Integrated Datalink Terminal HWCI

The purpose of the Integrated Datalink Terminal HWCI is to provide an interface between the Datalink Control Module HWCIs and the LOS Antenna Assembly HWCI.

Figure 4.1.1.4.1-1 shows an interconnectivity diagram of the Integrated Datalink Terminal HWCI in addition to the LOS Antenna Assembly HWCI and the VME Computer Assembly HWCI. These additional elements are included to illustrate the connectivity between LOS RF communication equipment.

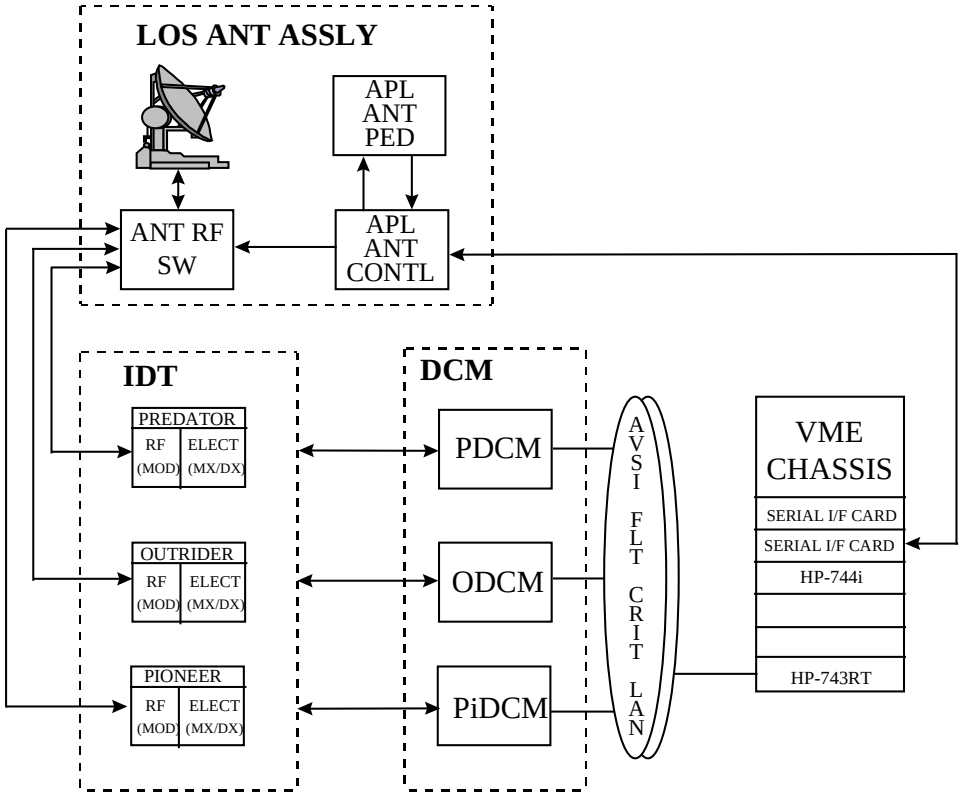

Figure 4.1.1.4.1-1 Integrated Datalink Terminal HWCI Interconnectivity Diagram

The Integrated Datalink Terminal HWCI shall send TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L). (SSS036)[SSDD126

The Integrated Datalink Terminal HWCI shall be capable of routing RS170A video and digital imagery to TCS functions. (SSS198) [SSDD127]

Figure 4.1.1.4.1-2 IDT Block Diagram show the main elements of the IDT component.

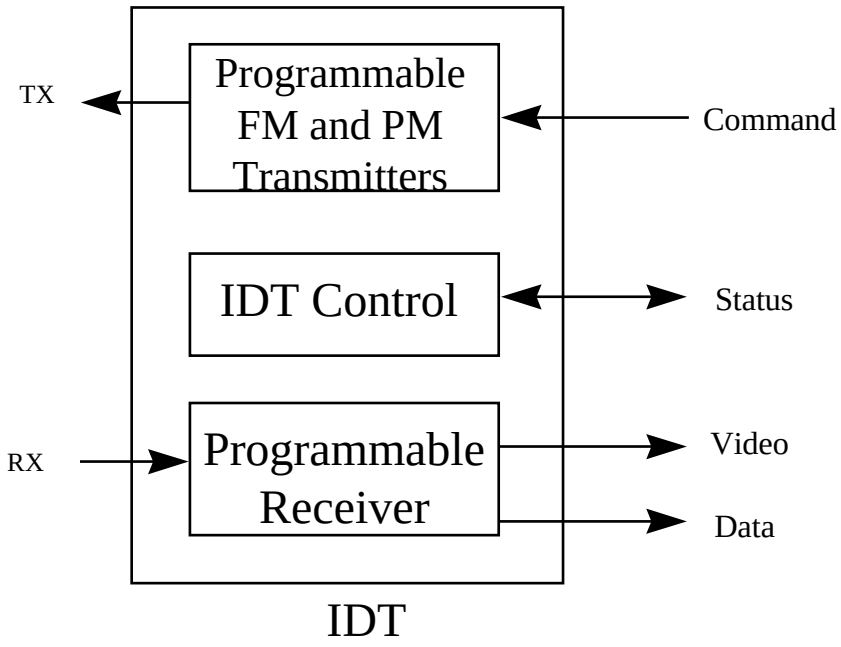

Figure 4.1.1.4.1-2 IDT Block Diagram

4.1.1.4.2 Ku Datalink Terminal HWCI

The purpose of the Ku Datalink Terminal HWCI is to provide an interface between the Datalink Control Module HWCIs and Ku equipped AVs.

Figure 4.1.1.4.2-1 shows a diagram of the Ku Datalink Terminal HWCI in addition to the Ku Antenna Assembly HWCI and the SAR Processor HWCI. These additional elements are included to illustrate the connectivity between Ku RF communication equipment.

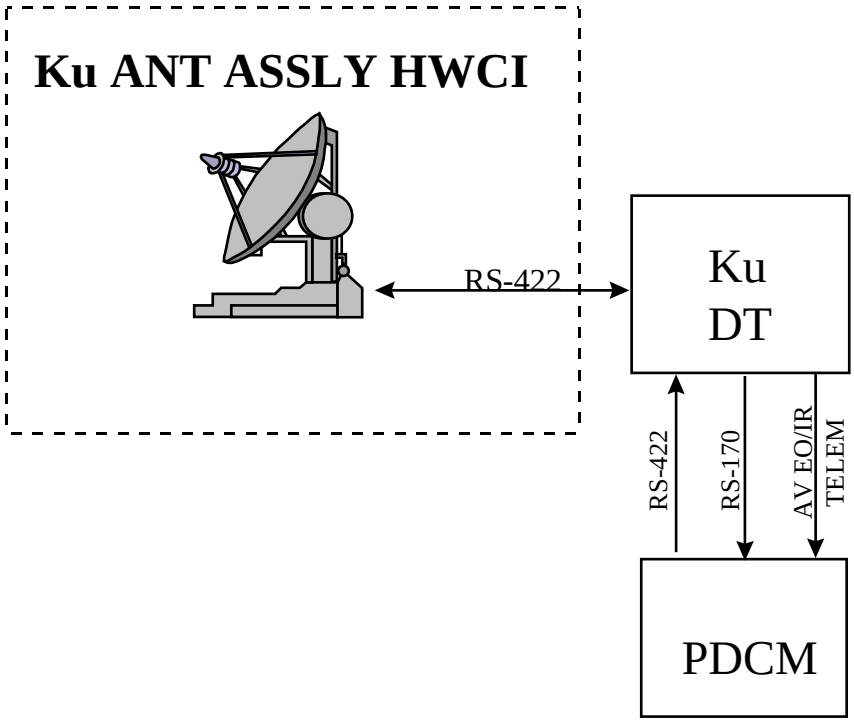

Figure 4.1.1.4.2-1 Ku Datalink Terminal HWCI Interconnectivity Diagram

The Ku Datalink Terminal HWCI to be used with present TCS configurations is the downsized Lockheed Martin terminal. Figure 4.1.1.4.2-2 Lockheed Martin Downsized Terminal Assembly Block Diagram shows the main elements that comprise the terminal and the associated interconnectivity.

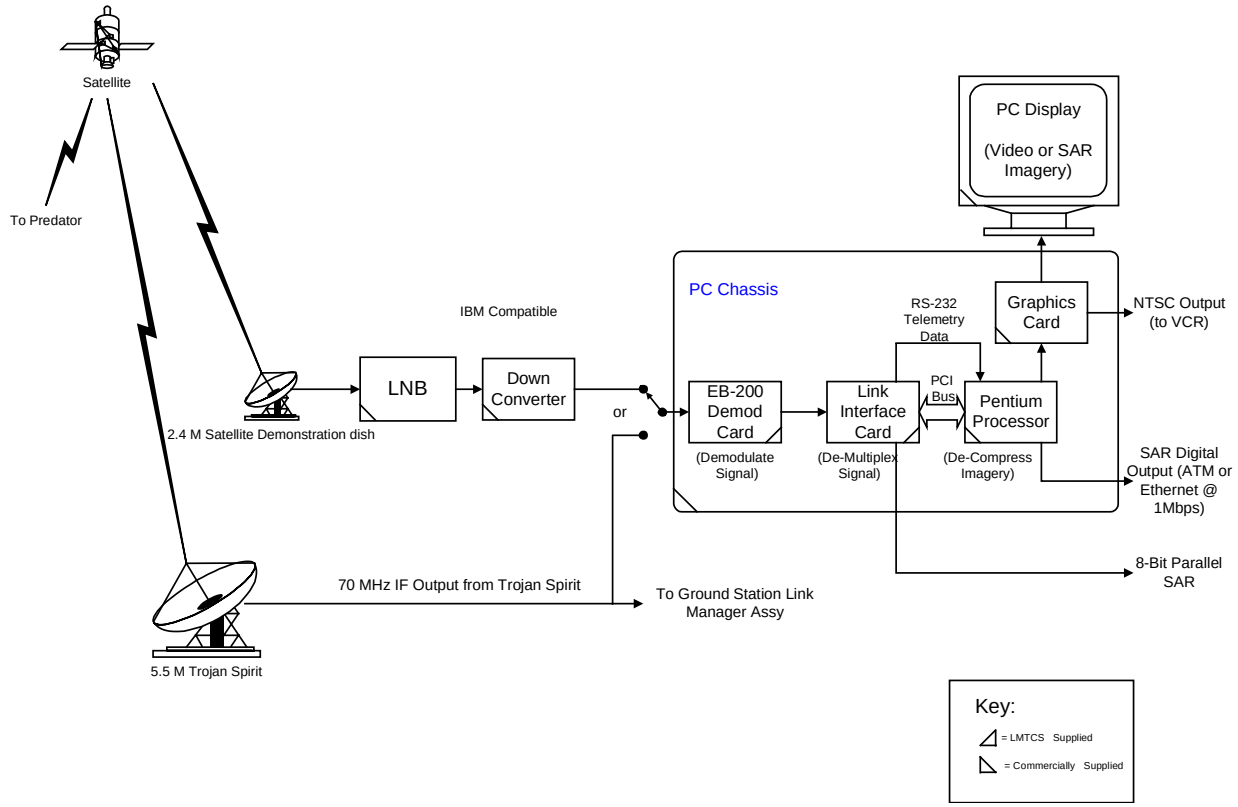

Figure 4.1.1.4.2-2 Lockheed Martin Downsized Terminal Assembly Block Diagram

The Trojan Spirit II Datalink Terminal will be utilized as a alternative solution if required..

The Trojan Spirit II Datalink Terminal can provide up to 14 circuits (8 SCI/6 collateral) using variable baud rates from 4.8 to 512 kbps per channel and will operate on either C, Ku, or X frequency bands.

The Trojan SPIRIT II system's technical characteristics are:

- Configurable for C/Ku-band satellite communications, and X-band in some cases
- Max data rate 512 kb/s; nominal 64 to 512 kb/s
- Primary shelter, spare equipment module, and mobile antenna platform
- 2.4 meter mobile antenna for V1/3 systems, and 5.5 meter antennas for X-band operations
- Basis of Issue Plan (BOIP): Field to division through theater MI brigades

The Ku Datalink Terminal HWCI shall send the TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L). (SSS036)[SSDD128]

The Ku Datalink Terminal HWCI shall be capable of routing RS170A video and digital imagery to

TCS functions. [SSS198] [SSDD129]

4.1.1.5 Datalink Control Module HWCIs

The purpose of the Datalink Control Module (DCM) HWCI is to provide the TCS the functionality to perform real-time processing in order to maintain closed-loop communication and control of the AV as well as the required control of ground based datalink components and communication with the TCS components. The TCS will have DCMs for the following AVs: Predator, Outrider, and Pioneer

The Datalink Control Module HWCI will be comprised of the Predator Data Control Module (PDCM), Outrider Data Control Module (ODCM), and Pioneer Data Control Module (PiDCM).

The Datalink Control Module HWCIs will transfer data to the RTP CSCI in accordance with the AV Standard Interface.

The DCM HWCIs shall be initialized upon operator selection of a specific AV for use in ground based closed loop command and control functions. (SSS109)[SSDD130]

For detail design requirements and associated information refer to the Tactical Control Module (DCM) Hardware Development Specification, Version 1.0 dated 20 June 1997.

4.1.1.5.1 Predator Datalink Control Module HWCI

The purpose of the Predator DCM HWCI is to provide the TCS with the capability to command and control the Predator AV and associated payloads. Figure 4.1.1.5.1-1 Predator Datalink Control Module HWCI Interconnectivity Diagram shows the main elements of the component and the associated interconnectivity.

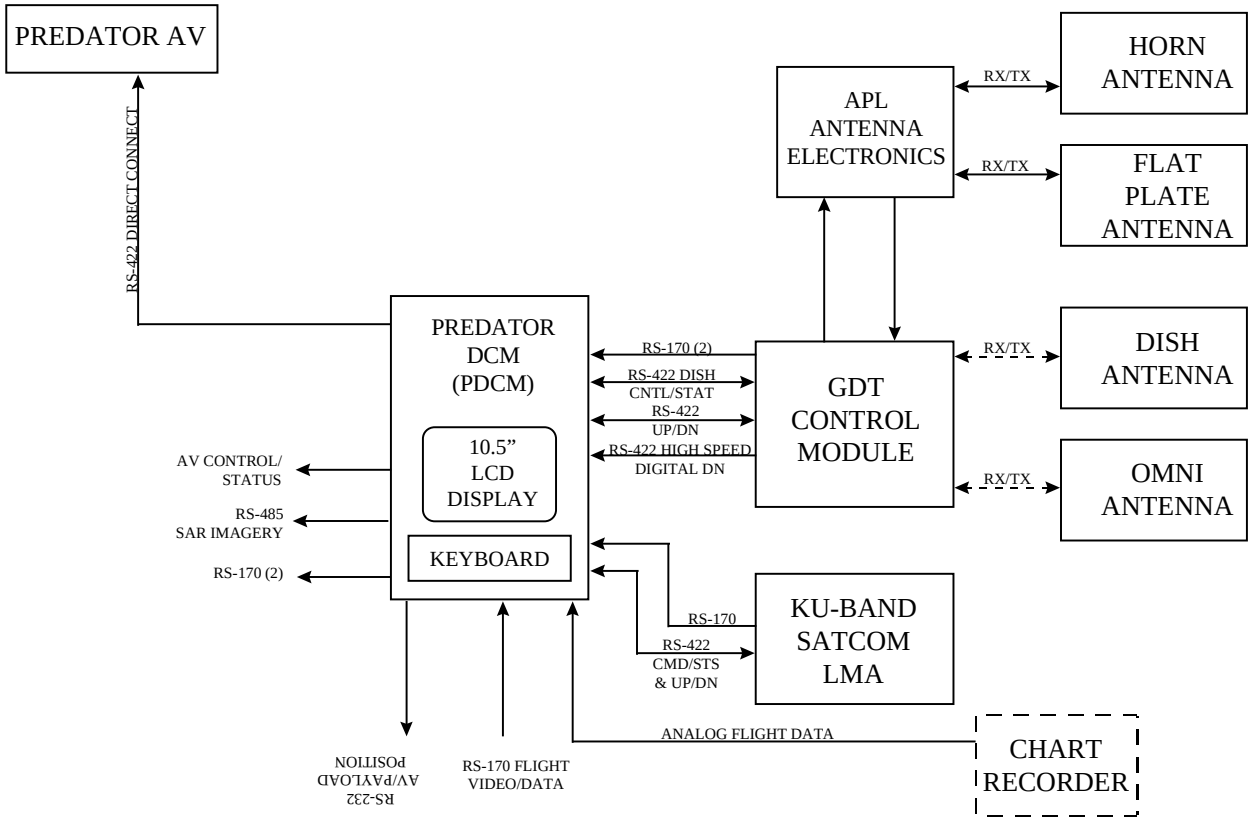

Figure 4.1.1.5.2-1 Predator DCM HWCI Interconnectivity Diagram

The Predator Datalink Control Module HWCI shall send the TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L). (SSS036) [SSDD131]

4.1.1.5.2 Outrider Datalink Control Module HWCI

The purpose of the Outrider DCM HWCI is to provide the TCS with the capability to command and control the Outrider AV and associated payloads. Figure 4.1.1.5.2-1 Outrider Datalink Control Module HWCI Interconnectivity Diagram shows the main elements of the component and the associated interconnectivity.

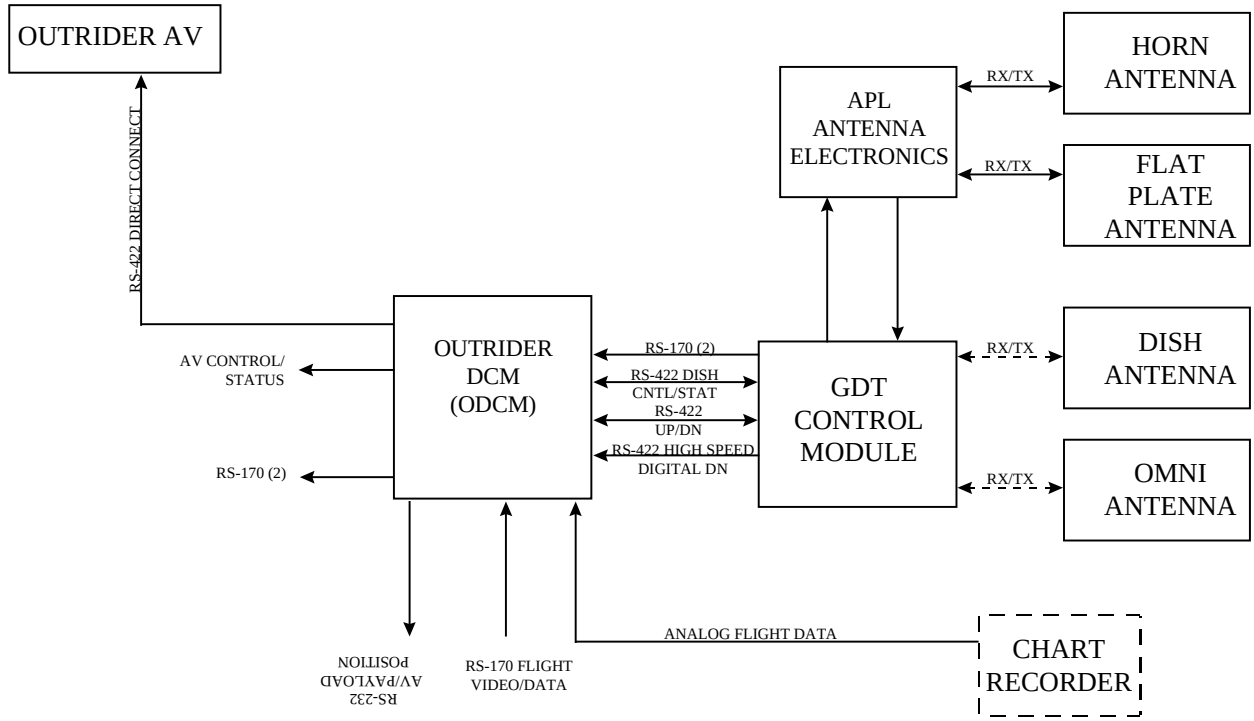

Figure 4.1.1.5.2-1 Outrider DCM HWCI Interconnectivity Diagram

The Outrider Datalink Control Module HWCI shall send the TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L). (SSS036)[SSDD132]

4.1.1.5.3 Pioneer Datalink Control Module HWCI

The purpose of the Pioneer DCM HWCI is to provide the TCS with the capability to command and control the Pioneer AV and associated payloads.

The Pioneer Datalink Control Module HWCI shall send the TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L). (SSS036)[SSDD133]

4.1.1.6 VCR HWCI

The purpose of the VCR HWCI is to provide the TCS with the ability to record and playback analog video payload data.

The VCR HWCI shall be able to record and playback downlinked video with or without overlayed telemetry data. [SSS195] [SSDD134].

The VCR HWCI shall send the TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L). (SSS036)[SSDD135]

4.1.1.7 External Storage HWCI

The purpose of the External Storage HWCI is to provide additional storage space to be available to the TCS Computer HWCI. The External Storage HWCI will provide the ability to store and retrieve files to include as a minimum: mission plans, flight route plans, communication plans, maps, C4I messages, digital image, NITF 2.0, activities and process log, and training.

The TCS shall provide external data storage devices. (SSS317) [SSDD136] These external storage devices may include a CD Drive, a Tape Drive, and/or a Redundant Array Of Inexpensive Disks (RAID).

The external data storage devices shall be able to receive and transmit digital data or digital imagery to and from the TCS. (SSS3180 [SSDD137]

The external data storage devices shall be expandable to include additional storage without major hardware reconfiguration. (SSS)[SSDD138]

The external data storage devices shall be capable of providing a 50% spare storage capacity over delivered storage used (SSS)[SSDD139]. As an objective, a 75% storage capacity over used shall be provided (SSS)[SSDD140]. The external data storage devices shall be expandable to include additional storage without major hardware reconfiguration (SSS)[SSDD141].

The purpose of the External Storage HWCI is to provide storage of digital data and digital imagery that can be retrieved later for processing. This enables internal storage to be free to receive and process priority data.

The TCS shall be provide external data storage devices that may include a CD Drive, a Linear Digital Tape Drive, and a Redundant Array Of Inexpensive Disks (RAID). (SSS)[SSDD142]

The external data storage devices shall be able to receive and transmit digital data or digital imagery to and from the TCS. (SSS)[SSDD143]

The TCS External Storage HWCI shall be expandable to include additional storage without major hardware reconfiguration. (SSS)[SSDD144]

The TCS External Storage HWCI shall allow for data storage expansion such as external storage media devices like tape, disk and CD drives(SSS376) [SSDD145] The External Storage HWCI shall send TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L). (SSS036) [SSDD146]

4.1.1.8 TCS Printer HWCI

The purpose of the TCS Printer HWCI is to provide the TCS with the capability to print hard copies.

The TCS Printer HWCI shall provide an internal hard copy printer to print digital imagery, C4I Messages, Mission Plans, and FD/L information. (SSS338)[SSDD147]

The TCS Printer HWCI shall send TCS Core Functionality CSCI the results of its periodic Fault

Detection/Location (FD/L). (SSS036)[SSDD148]

4.1.1.9 Uninterruptible Power Supply HWCI

4.1.1.9.1 TCS Workstation UPS

4.1.1.9.2 Support Equipment UPS

The TCS shall be capable of restoring power in sufficient time to avoid loss of air vehicle control during power outages. (SSS354)[SSDD149]

The TCS Uninterruptible Power Supply HWCI shall provide an uninterruptible power supply for critical phases of mission execution, landing and takeoff as a minimum design requirement. (SSS388) [SSDD150]

The TCS Uninterruptible Power Supply HWCI shall provide TBD minutes/hours to systematically and safely perform mission critical functions without loss of data or air vehicle control.(SSS388)[SSDD151]

The TCS Uninterruptible Power Supply HWCI shall provide electrical/electronic equipment protection to prevent power surge/power failure damage. (SSS388) [SSDD152]

The Uninterruptible Power Supply HWCI shall provide backup capability such that upon loss of the primary power supply, the TCS shall be capable of restoring and maintaining electrical backup power to avoid critical mission data loss, computer memory loss, or loss of AV control. The TCS. (SSS387) [SSDD153]

The TCS Uninterruptible Power Supply HWCI shall send the TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L). ([SSS036) [SSDD154]

4.1.1.10 Intercom Equipment HWCI

The TCS shall incorporate an Intercom Equipment HWCI that provides verbal communications in the situation where there are multiple operators. (SSS331)[SSDD155]

The Intercom Equipment HWCI shall be compatible with service specific voice communication systems. (SSS332)[SSDD156]]

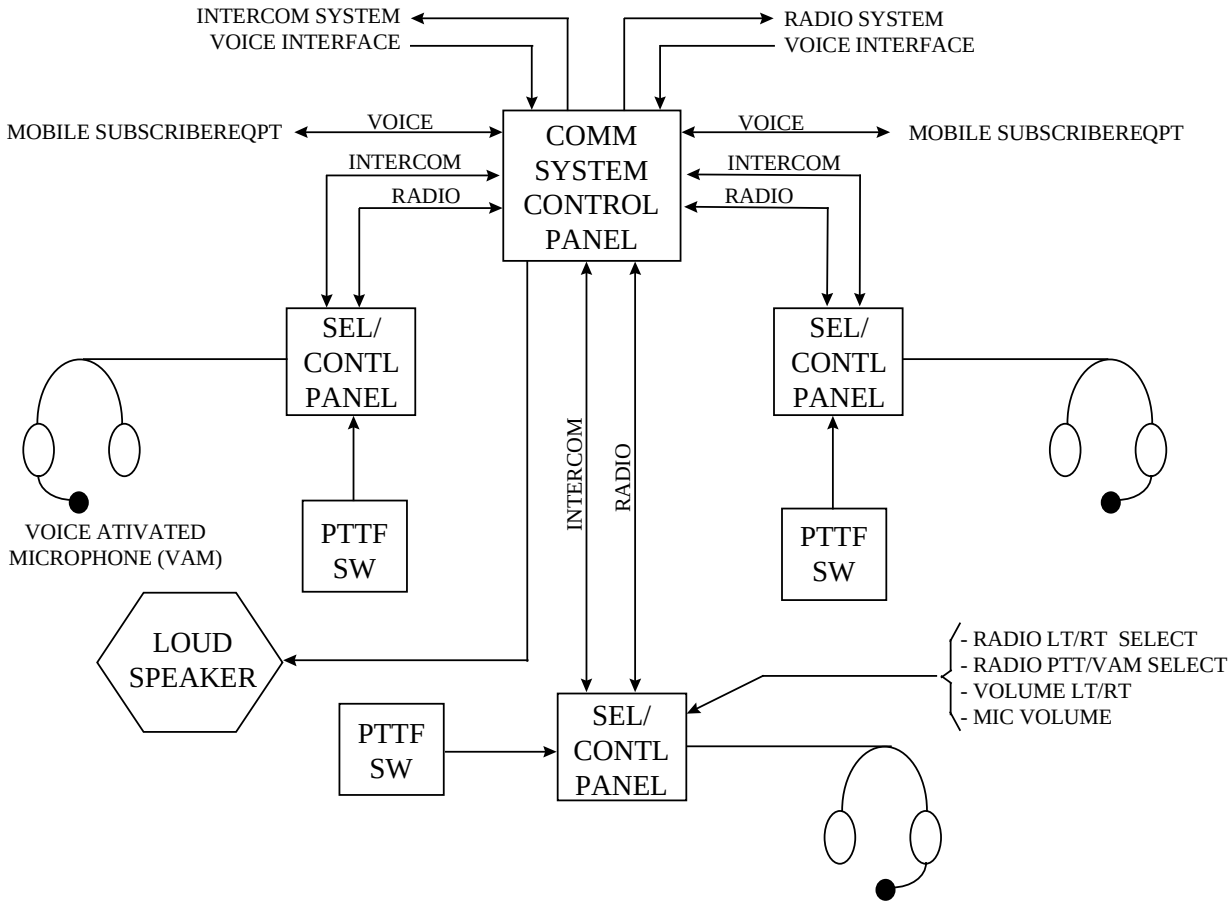

Figure 4.1.1.10-1 Intercom HWCI Interconnectivity Diagram

4.1.1.11 C4I Support Equipment HWCI

The C41 Support Equipment shall send TCS Core Functionality the results of its periodic Fault Detection/Location (FD/L). (SSS036)[SSDD157]

The C4I Support Equipment shall provide the capability to interface with military and commercial satellite communications equipment. (SSS285)[SSDD158]

4.1.1.12 Communication Equipment HWCI

The TCS shall provide communications with other military units via the Mobile Subscriber Equipment (MSE) and Single Channel Ground/Airborne Radio System (SINCGARS) interfaces to transmit/receive messages and image data.

The Tactical Communication equipment utilized with the TCS shall be comprised of currently developed or fielded (standard) communication equipment (telephones and radios) that is used in association with the TCS for communication.(SSS)[SSDD159]

TCS and Tactical Communication Link interface shall provide data communication provision for Mobile Subscriber Equipment (MSE) and SINCGARS (i.e., 1 MSE channel and 1 SINCGARS channel).

The TCS shall provide the capability to interface with a MSE TSEC/KY-68 telephone terminal to provide the capability for secure voice and data communications via telephone.

The TCS shall provide the capability to interface with a SINCGARS AN/VRC-91A to provide the capability for secure data communications.

The TCS shall include digital communication protocols supporting United States Message Text Format (USMTF), Intelligence and Electronic Warfare (IEW) Character Oriented Message (COM) Catalog (IEWCOMCAT) and Marine Tactical System (MTS).

The TCS Communication Equipment shall allow for long range communication from one TCS to another via Wide Area Network (WAN), interoperable C4I systems, and UAV data relay. (SSS375) [SSDD160]

There is no core communication equipment. See Appendix A and B for the respective TCS-LS and TCS-SB specific equipment.

4.1.1.13 Operator Output HWCI

The purpose of the Operator Output HWCI is to provide the necessary hardware to allow the operator(s) of TCS to perceive information from the TCS Computer HWCI. The Operator Output HWCI will consist of one or more visual display devices.

The Operator Output HWCI shall provide the operator with the capability to command the system to the shutdown state from all modes under the Operations State. (SSS035)[SSDD161]

The Operator Output HWCI shall send TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L). (SSS036)[SSDD162]

The Operator Output HWCI shall provide display(s), that allows the operator the ability to define waypoints on a map based display using a pointing device with full keyset redundancy. (SSS059)[SSDD163]

The Operator Output HWCI shall support redundancy in all operator interface operations, so that the loss of any one display output device does not prohibit operation of any TCS function. (SSS463)[SSDD164]

The Operator Output HWCI shall have ergonomically designed operator controls and displays for the 5^{th} percentile female to 95^{th} percentile male operator. (SSS443)[SSDD165]

The Operator Output HWCI controls shall allow an Operator performing all air vehicle, payload, and C4I Communication activities while wearing or not wearing cold weather clothing and in a Mission Oriented Protective Posture. (SSS444)[SSDD166]

The Operator Output HWCI shall provide a minimum of TBD (450) square inches of display surfaces area. The resolution of all displays shall be a minimum of TBD (6.4 x 8.2) pixels per square inch. Each display shall have a minimum 256 colors. Each display shall have the equivalent of TBD (16) shades of gray.([SSS446)[SSDD167]

The Operator Output HWCI shall have monitor(s) that provide easy reading of displays under direct sunlight and low light level environments. (SSS446) [SSDD168] Display jitter and flicker shall not be perceptible by the operator. (SSS459) [SSDD169]

The Operator Output HWCI shall have, at a minimum, the functionality to display the following four display windows: (SSS405) [SSDD170]

i. Display to provide aircraft position, TCS position, flight path, and waypoint graphics in the foreground which are positioned in relation to a map displayed in the background

ii. Display to provide aircraft flight data or payload data in the foreground, and downlinked video in the background

iii. Display to provide graphic presentations of downlinked telemetry data

iv. Display to present the interface menus for workstation software

4.1.1.14 Operator Input HWCI

The purpose of the Operator Input HWCI is to provide the necessary hardware to allow the operator(s) of TCS to input information into the TCS Computer HWCI. The Operator Input HWCI will consist of, as a minimum, the following elements keyboard, trackball, and joystick.

The Operator Input HWCI shall provide the operator with the capability to command the system to the shutdown state from all modes under the Operations State. (SSS035)[SSDD171]

The Operator Input HWCI shall send TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L). (SSS036)[SSDD172]

The Operator Input HWCI shall provide input devices, that allows the operator the ability to define waypoints on a map based display using a pointing device with full keyset redundancy. (SSS059)[SSDD173]

The Operator Input HWCI shall support redundancy in all operator interface operations, so that the loss of any one HCI input device does not prohibit operation of any TCS function. (SSS463)[SSDD174]

The Operator Input HWCI shall include an off-the-shelf, complex control joystick with at least two X/Y control devices, multiple toggle and multi-position switches as part of the Work Station Console. (SSS468)[SSDD175]

The Operator Input HWCI shall have ergonomically designed operator controls and displays for the 5^{th} percentile female to 95^{th} percentile male operator. (SSS443)[SSDD176]

The Operator Input HWCI controls shall allow an Operator performing all air vehicle, payload, and C4I Communication activities while wearing or not wearing cold weather clothing and in a Mission Oriented Protective Posture. (SSS444)[SSDD177]

4.1.1.15 VME Computer Assembly HWCI

The purpose of the VME Computer Assembly HWCI is to provide the real time processing capability to the TCS. Figure 4.1.1.15-1 VME Computer Assembly HWCI Interconnectivity Diagram show the main elements of the component and the associated interconnectivity.

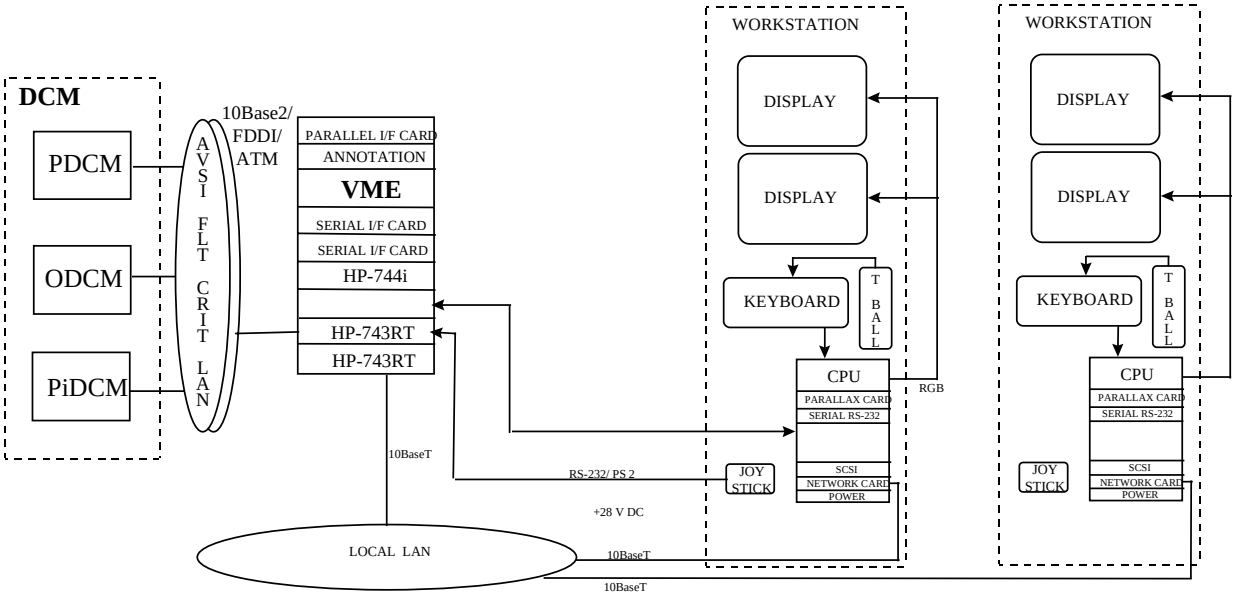

Figure 4.1.1.15-1 VME Computer Assembly HWCI Interconnectivity Diagram

4.1.1.16 Integrity Beacon Landing System (IBLS) HWCI

The purpose of the Integrity Beacon Landing System (IBLS) HWCI is to provide the TCS with a differential Global Positioning System (GPS) launch and recovery system to allow TCS to track and control the recovery of AVs tht are IBLS capable. The IBLS HWCI will provide AV guidance and control functions and commands to the TCS Computer HWCI for transmission to the AV.

The IBLS shall send TCS Core Functionality the results of its periodic Fault Detection/Location (FD/L). (SSS036)[SSDD178]

4.1.1.17 CARS HWCI

The purpose of the CARS HWCI is to provide a microwave Ka-band radar-base track system to allow TCS to track and control the recovery of AVs that are CARS capable. The CARS HWCI will provide AV guidance and control functions and commands to the TCS Computer HWCI for transmission to the AV.

The CARS shall send TCS Core Functionality the results of its periodic Fault Detection/Location (FD/L). (SSS036)[SSDD179]

4.1.1.18 Linear Digital Tape Drive HWCI

The purpose of the Linear Digital Tape Drive HWCI is to provide TCS the ability to record raw SAR data.

The Linear Digital Tape Drive shall send TCS Core Functionality the results of its periodic Fault Detection/Location (FD/L). (SSS036)[SSDD180]

4.1.1.19 C-Band LOS Antenna Assembly HWCI

The purpose of the C-Band LOS Antenna Assembly HWCi is to provide the antenna subsystem that will allow the TCS to communicate over C-Band LOS to appropriate AVs.

The C-Band LOS Antenna Assembly HWCI shall be capable of being situated in a location such that the LOS antenna is not blocked by the surrounding terrain or man made obstructions. (SSS170) [SSDD181]

Figure 4.1.1.19-1 C-Band LOS Antenna Assembly Diagram provides the physical interconnectivity of the antenna assembly and associated components.

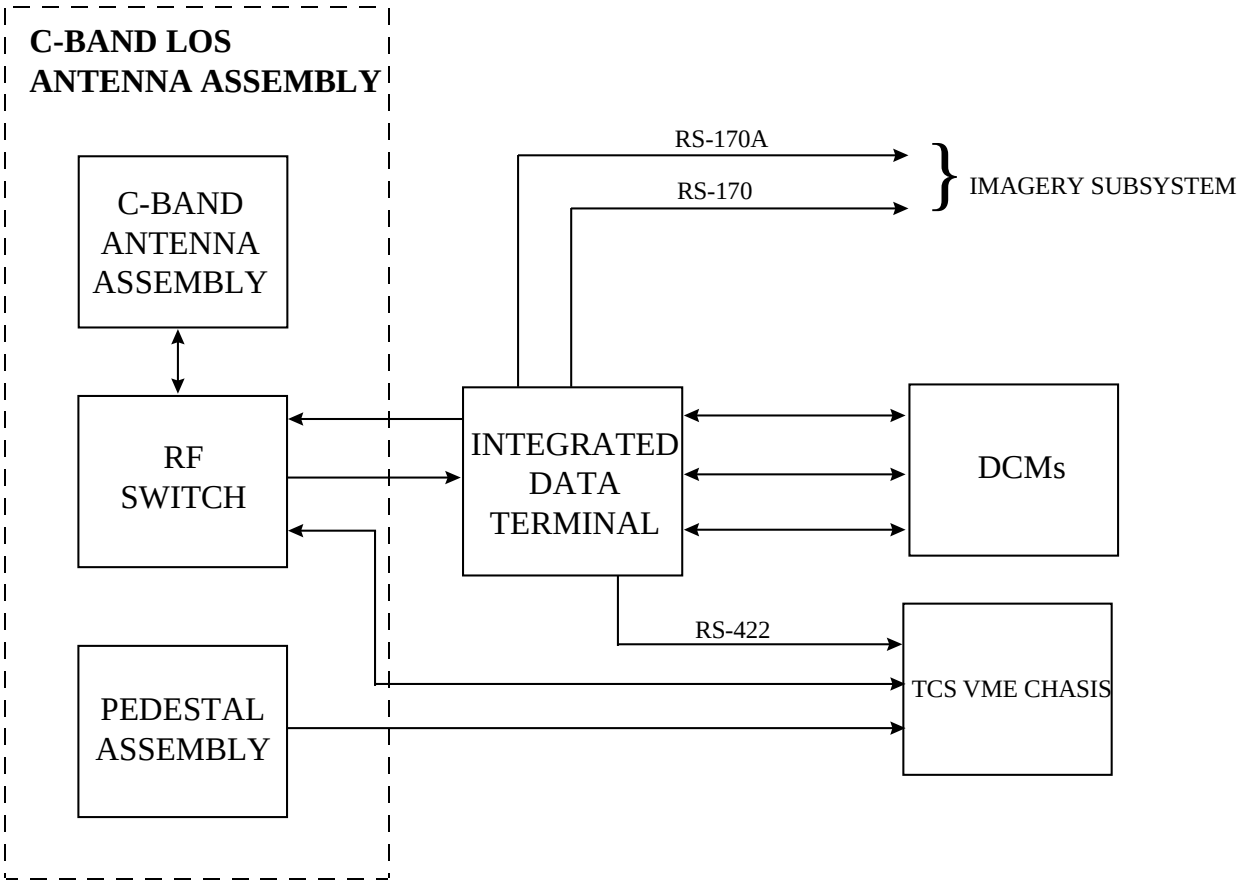

Figure 4.1.1.19-1 C Band LOS Antenna Assembly Diagram

4.1.1.20 Ku Antenna Assembly HWCI

The purpose of the Ku Antenna Assembly HWCI is to provide the antenna subsystem that will allow the TCS to communicate over Ku-Band SATCOM to SATCOM capable AVs.

The Ku Antenna Assembly HWCI shall be capable of being situated in a location such that the antenna is not blocked by the surrounding terrain or man made obstructions. [SSS170] [SSDD182]

Figure 4.1.1.20-1 Ku-Band SATCOM Antenna Assembly Diagram provides the physical interconnectivity of the antenna assembly and associated components.

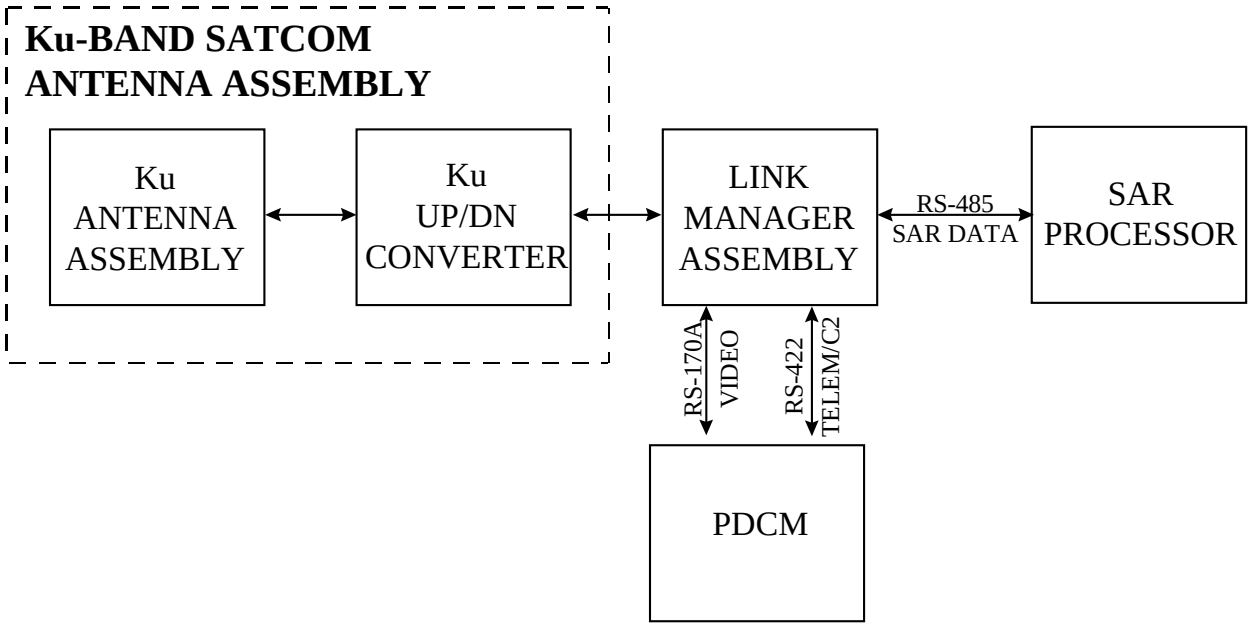

Figure 4.1.1.20-1 Ku Band SATCOM Antenna Assembly Diagram

4.1.1.21 Redundant Array of Inexpensive Disks HWCI

The purpose of the Redundant Array of Inexpensive Disks HWCI is to provide TCS a buffer storage device for approximately 10 minutes of SAR data.

4.1.1.22 Power Distribution HWCI

The purpose of the Power Distribution HWCI is to condition and provide the necessary power to the various components of the TCS. Figure 4.1.1.22 Power Distribution HWCI Interconnectivity Diagram show the main elements of the component and their interconnectivity.

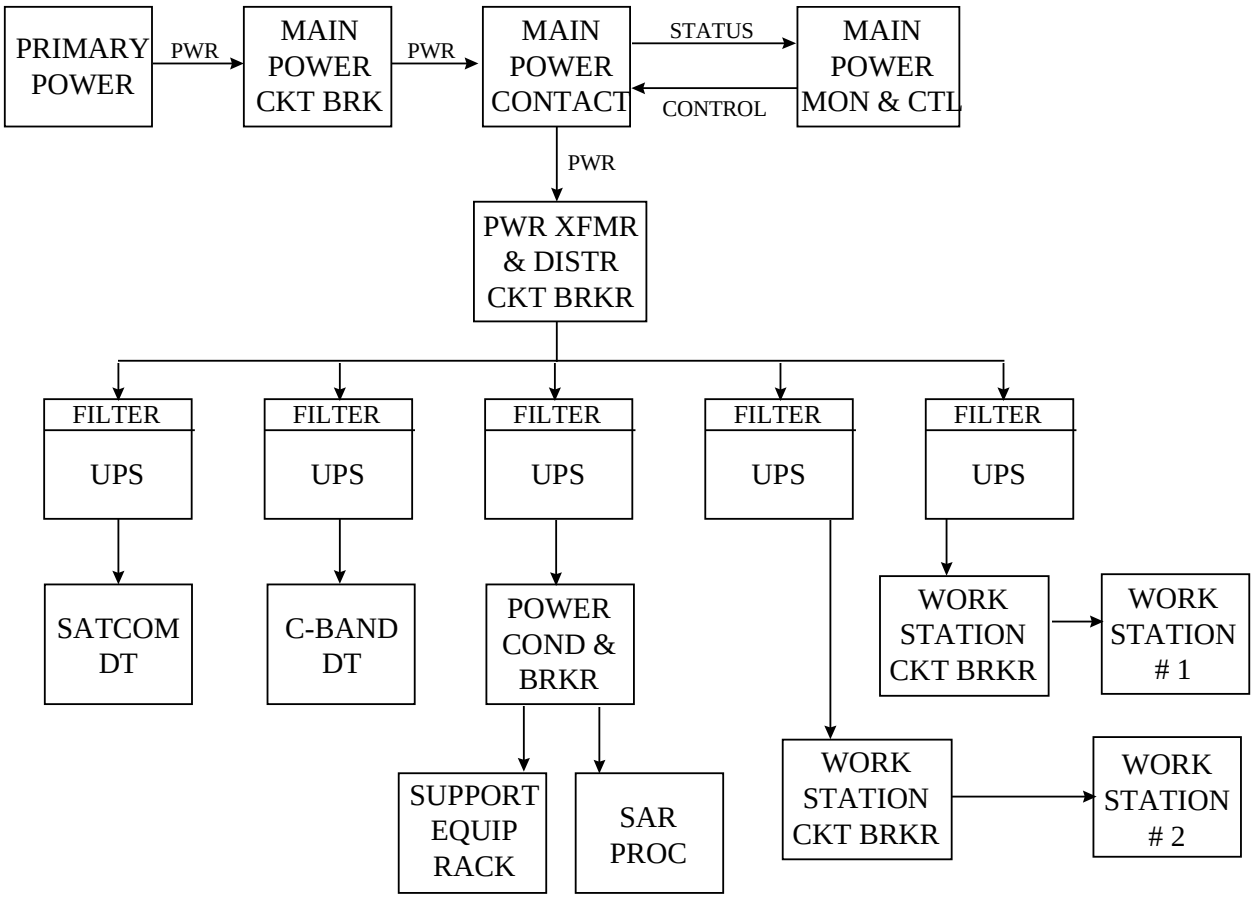

Figure 4.1.1.22-1 Power Distribution HWCI Interconnectivity Diagram

The TCS Power Distribution HWCI shall use standard military worldwide 110/220 volt 50/60 hertz generators and commercial power sources. [SSS385] [SSDD183].

The TCS HWCIs shall use standard electrical power sources available within the DoD family of ground mobile, airborne, and shipboard electrical power sources, dependent on installation platform. (SSS386) [SSDD184].

4.1.2 TCS Computer Software Configuration Items (CSCI)

4.1.2.1 All TCS CSCIs

Each of the TCS CSCIs will conform to the following basic requirements:

1. Design Standards
2. Security
3. Reliability
4. Training
5. Warnings
6. HCI

7. System Status

4.1.2.1.1 Design Standards

The TCS CSCIs shall be based on Defense Information Infrastructure/ Common Operating Environment as per Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (ASD(C3I)) Joint Technical Architecture. (SSS393) [SSDD185]

The TCS CSCIs shall comply with the Assistant Secretary of Defense (C3I) Joint Technical Architecture (JTA). This includes, as a minimum, the language, the computer, the database, architecture, and interoperability. (SSS394) [SSDD186]

The TCS CSCIs shall provide an open software architecture to be capable of supporting additional CSCIs, CSCs, and CSUs for future AVs, future payloads, and payload capabilities (e.g. auto-search and automatic target tracking), and future Tactical UAVs. (SSS395) [SSDD187]

The TCS CSCIs shall be generically written to provide level one through level five interaction for both Outrider and Predator UAVs and establish the architecture for future Tactical UAVs. (SSS396) [SSDD188]

All TCS CSCIs shall be capable of being hosted on service specific computer operating systems such as TAC-X (Navy), CHS-II/SPARC 20 (Army, Marines), and SGI/DEC (Air Force) as specified in the TCS Workstation HWCIs. (SSS398) [SSDD189]

The TCS CSCIs shall provide a windows based graphic operator interface. (SSS399) [SSDD190]

The TCS CSCIs shall be non proprietary and have unlimited data rights. (SSS400) [SSDD191]

The TCS CSCIs shall be re-programmable without hardware disassembly. (SSS401) [SSDD192]

TCS CSCIs flexibility and expandability shall be provided through use of the DII/COE and through use of standardized software development practices. (SSS417) [SSDD193]

The TCS CSCIs shall provide the common software architecture for TCS interaction with Predator, Outrider, and future Tactical UAVs. (SSS425) [SSDD194]

Newly designed TCS CSCIs shall be developed in accordance with a tailored MIL-STD-498. (SSS437) [SSDD195]

Software written for other systems shall be used in TCS CSCIs where it is determined that the existing software is suitable and provides the required functionality. (SSS438) [SSDD196]

A modular architecture shall be used by the TCS CSCIs in order to support future interoperability with multiple types of UAVs and payloads while maintaining consistent displays and user interfaces. (SSS439) [SSDD197] Software components satisfying common planning and control functions shall allow for Air Vehicle specific components to be integrated in the future.

4.1.2.1.2 Security

The TCS is an Automated Information System (AIS). As such, as per DoD Regulation 5000.2-R, dated March 15, 1996, all TCS CSCIs shall satisfy all software security requirements in accordance with DoD Directive 5200.28(D), "Security Requirements for Automated Information Systems" dated March 21, 1988. (SSS361)[SSDD198]

The TCS CSCIs shall be accredited by the Designated Approving Authority prior to processing classified or sensitive unclassified data. (SSS362)[SSDD199]

Using risk assessment procedures defined in DoD 5200.28(D), a risk index and the minimum security requirements for access to the TCS CSCIs shall be determined. (SSS363)[SSDD200] The inputs to this procedure is the clearance or authorization of the TCS users and the sensitivities of the data that the TCS processes, stores or transfers. These requirements pertain to the TCS computer hardware and software

The TCS CSCIs data sensitivities shall be determined by the data sensitivities of the systems with which they interface with, including the air vehicles, payloads, and C4I systems. (SSS364)[SSDD201] The outputs of this procedure are the TCS mode of operation and a digraph that the TCS must minimally satisfy. The digraph (e.g., B1, C2) names the class of security requirements, specified in DoD 5200.28-STD, "Trusted Computer Security Evaluation Criteria (TCSEC)", that the TCS CSCIs have to satisfy.

All hardware, software, documentation, and sensitive information used in conjunction with TCS CSCIs shall be physically protected, minimally at the level determined by the risk index computed in **relationship to requirements SSS363 and SSS364**, to prevent intentional or unintentional disclosure, destruction, or modification. (SSS367)[SSDD202]

The TCS CSCIs shall be physically secured to the same degree as the systems with which they interface. (SSS368)[SSDD203]

All TCS programmers, users, operators, maintainers and other personnel having access to the TCS CSCIs shall be cleared to the highest sensitivity of the data that the TCS processes, stores or transfers. (SSS369)[SSDD204]

Additional local site procedures, for the TCS CSCIs, shall be developed to prevent the intentional or unintentional disclosure of sensitive information to unauthorized individuals. (SSS370)[SSDD205] These procedures will include the use of passwords for access to the TCS CSCIs.

4.1.2.1.3 Reliability

Testability shall be considered in the design and development of the TCS CSCIs. (SSS421) [SSDD206]

The TCS CSCIs shall provide the capacity for detection and isolation of internal faults. (SSS423) [SSDD207]

The TCS CSCIs shall define Test points and data paths to support the testing strategy.

(SSS424)[SSDD208]

4.1.2.1.4 Training

Additional TCSs shall be required to support the Joint DoD UAV Training Center. (SSS) [SSDD209]

All CSCIs via the Work Station Console shall provide a high resolution, computer generated, graphics user interface that enables the UAV operator that is trained on one system to control different types of UAVs or UAV payloads with minimal additional training. (SSS404)[SSDD210]

4.1.2.1.5 Warnings

The TCS CSCIs shall provide the operator a caution and warning diagnostic when the TCS system has identified a malfunction. (SSS445) [SSDD211]

When performing a given task during mission execution, the TCS CSCIs shall provide the operator with appropriate warning messages from other concurrently-executing subsystem tasks. (SSS448) [SSDD212]

The TCS CSCIs shall provide warning messages that are color coded and flashed based on mission criticality. The color codes and flash frequencies will follow MIL-STD 1472 guidelines. (SSS449) [SSDD213]

The TCS CSCIs shall require the operator to enter an acknowledgment prior to disabling the display of critical warning flags for any AV, Payload, ADT, GDT, and TCS faults. (SSS450) [SSDD214]

The TCS CSCIs shall provide visual alerts to the operator in the form of a displayed message box that has a display priority greater than other existing windows to ensure that it is viewable immediately by the operator. (SSS452) [SSDD215] The position of the displayed message window shall be easily adjustable by the operator to ensure that important mission data is not obscured. (SSS453) [SSDD216]

In addition to displayed alert messages, the TCS CSCIs shall provide auditory alerts to include tones to the TCS operator. (SSS454) [SSDD217] The volume of these auditory tones shall be adjustable by the operator via keyboard and trackball input to at least 20dB above the speech interference level at the operator's ear. (SSS455) [SSDD218] The TCS CSCIs shall archive warning messages and HCI actions for later review. (SSS456) [SSDD219]

All operator inputs shall be error checked by the respective TCS CSCI against reasonable minimum and maximum values such that any erroneous operator entry will not cause current processing to terminate. (SSS457)[SSDD220] Upon detecting an operator input error, the TCS CSCIs shall prompt the operator for a valid input. (SSS458) [SSDD221]

For AV safety or mission-critical Warnings, the TCS CSCIs shall provide a default selection as well as an override option, along with a selection of adaptive responses, and the minimum information necessary to assist the operator in responding quickly and adaptively to the emergency. (SSS487)

[SSDD222]

4.1.2.1.6 HCI

The TCS CSCIs shall have, at a minimum, the functionality to display the following four display windows: (SSS405) [SSDD223]

i. Display to provide aircraft position, TCS position, flight path, and waypoint graphics in the foreground which are positioned in relation to a map displayed in the background

ii. Display to provide aircraft flight data or payload data in the foreground, and downlinked video in the background

iii. Display to provide graphic presentations of downlinked telemetry data

iv. Display to present the interface menus for workstation software

The TCS CSCI controls shall allow the air vehicle and payload operators to perform mission control, mission monitoring, and mission updates and modifications while wearing cold weather clothing and in a Mission Oriented Protective Posture. (SSS444) [SSDD224]

The TCS CSCIs shall be menu driven and have displays in a X-windows motif. (SSS447) [SSDD225]

The TCS CSCIs shall error check all operator inputs such that any erroneous operator entry will not cause current processing to terminate. (SSS457) [SSDD226] The HCI shall prompt the operator for a valid input. (SSS458) [SSDD227]

The TCS CSCIs, and their associated HCIs, shall not generate display jitter and flicker detectable by the operator. (SSS459)[SSDD228]

The TCS CSCIs shall provide HCI that supports operation of the system in the Start-Up, Operations, and Shutdown States. (SSS461) [SSDD229].

The TCS CSCIs shall provide HCI that supports operation of the system in the Normal Operations, Training Operations, and Maintenance Operations Modes. (SSS461) [SSDD230]

The TCS CSCIs shall provide HCI that supports operation of the system for the following functions of the Normal and Training Operations Modes: Mission Planning, Mission Control and Monitoring, Payload Processing, Targeting, and C4I Interfacing. (SSS461) [SSDD231]

The TCS CSCIs shall provide HCI that supports operation of the system for the following functions of the Maintenance Operations Mode: AV Maintenance, Payload Maintenance, Datalink Terminal Maintenance, Workstation and Peripheral Maintenance, Extensive FD/L, Software Upgrade, and Software Debug. (SSS461) [SSDD232]

The Human Computer Interfaces (HCIs), associated with each of the TCS CSCIs, shall be designed

and implemented in accordance with the HCI Design Approach for the UAV TCS document. (SSS462) [SSDD233]

The HCI, associated with each of the TCS CSCIs, shall provide redundancy in all operations, so that the loss of any one HCI input device does not prohibit operation of any TCS function. (SSS463) [SSDD234]

The TCS CSCs shall provide the functionality to display all HCI elements on any available monitor on the TCS workstation. (SSS464) [SSDD235]

The TCS CSCIs shall be capable of displaying a window within a window format to include, as a minimum, displaying a video window overlaid on a map screen as well as a map screen overlaid on a video screen.(SSS465) [SSD236]

The TCS CSCIs shall provide full complementary control operations from the keyset as well as the X/Y control devices (e.g., trackball, mouse, joystick).(SSS466) [SSDD237]

The TCS CSCIs shall provide access to the DII Style Manager to allow the modification of pointing device characteristics. (SSS467) [SSDD238] These pointing device characteristics will include, as a minimum, button configuration, double-click speed, icon selection, speed control, and trail selection.

The TCS CSCIs shall provide a capability for porting an off-the-shelf, complex control joystick with at least two X/Y control devices, multiple toggle and multi-position switches as part of the TCS hardware suite.(SSS468)[SSDD239]

The TCS CSCIs shall use graphical representations to convey information, such as system status, C4I links, and AV-GDT links.(SSS469) [SSDD240]

The TCS CSCIs shall provide for multi-level information display tailoring by the operator. (SSS470) [SSDD241]

The TCS CSCIs shall provide automated TCS system information, control options, and logical & simple operator guidance and support for immediate and adaptive responding to crisis situations. (SSS471) [SSDD242]

The TCS CSCIs shall provide maximum automated system software support to system status monitoring and alerting of the TCS operator when a preset system parameter goes under as well as over a set threshold. (SSS472) [SSDD243]

The TCS CSCIs shall provide the necessary processing, display, and control capabilities to ensure dynamic situational awareness input to the TCS operator.(SSS473) [SSDD244]

The TCS CSCIs shall minimize alphanumeric data display in favor of graphic, pictorial information display. (SSS474) [SSDD245]

The TCS CSCIs shall provide unambiguous AV and payload control and status feedback indicators to ensure safe, efficient operations of two AVs and their payloads by a single TCS station. (SSS475)

[SSDD246]

The TCS CSCIs shall provide for a specific icon shape on a constant contrast background, as well as other visual information coding mechanisms, to cue the TCS operator regarding which UAVs are under his or her primary control. (SSS476) [SSDD247]

The TCS CSCIs shall provide the capability to select and amplify an object and point on a map as well as payload screen. (SSS477) [SSDD248]

The TCS CSCIs shall provide coarse and fine payload control capabilities directly on the payload screen.(SSS478) [SSDD249]

The TCS CSCIs shall display the SAR imaging swath on the map display. (SSS479) [SSDD250] The TCS HCI shall provide the on-screen capability to select and efficiently move as well as reorient a previously defined SAR imaging swath. (SSS480) [SSDD251]

The TCS CSCIs shall provide the capability to lock onto and hold a coordinate point on the payload imagery window. (SSS481) [SSDD252]

The TCS CSCIs shall provide for a rapid means to cancel aural warnings. (SSS484) [SSDD253]

The TCS CSCIs shall provide for separation, grouping, and visual coding of multiple categories of alerts, to include Warnings, Cautions, and Advisories. (SSS485) [SSDD254]

The TCS CSCIs shall provide for visual Warnings, Cautions, and Advisories to be displayed at or near the center of the field of view, i.e., within a 30^{o} cone, of all monitors in a TCS system. (SSS486) [SSDD255]

The TCS CSCIs shall provide for on-screen information to include, as a minimum, overlays, headers, cursors, alphanumeric annotation, waypoints, crosshairs, designed to be visible against the complete spectrum of map and payload video backgrounds. (SSS488) [SSDD256]

The TCS CSCIs shall provide continuously-available, on-screen control functions for time and mission-critical operations, to include as a minimum print, freeze, declassification, mark VCR, declutter, cease RF transmission. (SSS489) [SSDD257]

The TCS CSCIs shall provide for the capability to automatically overlay designated target locations from the payload screen onto the map screen. (SSS490) [SSDD258]

4.1.2.1.7 System Status

The TCS CSCIs shall prevent Operations State modes from existing concurrently. (SSS033)[SSDD259]

The TCS CSCIs shall provide for Fault Detection/Location (FD/L) to the Line Replaceable Unit (LRU) level to indicate the readiness status of TCS. (SSS249) [SSDD259]

4.1.2.2 TCS Core Functionality CSCI

The TCS Core Functionality CSCI shall provide the UAV operator with the necessary tools for computer related communications, mission tasking, mission planning, mission execution, data receipt, data processing, and data dissemination. (SSS397) [SSDD260]

The TCS Core Functionality CSCI shall provide automatically recording of all TCS Core Functionality state data, interface communications and other information necessary to support event reconstruction. (SSS528) [SSDD261]

The TCS Core Functionality CSCI will consist of the following basic elements:

1. System Setup
2. TCS Main
3. AV Control
4. AV Flight Monitoring
5. Datalink Management and Control
6. EO/IR Payload Control
7. EO/IR Imagery Viewer
8. EO/IR Imagery Data Acquisition
9. C4I Messages
10. NITF Files
11. Targeting
12. Collection Tasking and Retasking
13. Launch and Recovery
14. Training
15. Maintenance

4.1.2.2.1 System Setup

The following TCS requirements are allocated to the System Status element of the TCS Core Functionality CSCI:

- TCS States and Modes and top level function control:
  - Start up processing control.
  - Power-down processing control.
  - Activation of other Software Tasks and Functions.
  - Termination of other Software Tasks and Functions.
  - Activation of other Hardware Tasks and Functions.
  - Termination of other Hardware Tasks and Functions.
- HCI Requirements

The TCS Core Functionality CSCI shall provide and control the TCS states of operation, Startup, Operation, and Shutdown. (SSS014)[SSDD262]

The TCS Core Functionality CSCI shall control the activation and termination of all TCS CSCIs via the Operating System. (SSS)[SSDD263]

The TCS Core Functionality CSCI shall ensure that the TCS states of operation do not exist concurrently. (SSS015)[SSDD264]

Figure 4.1.2.2-1 shows the TCS states of operation.

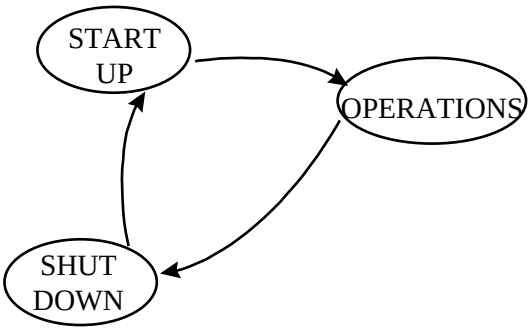

Figure 4.1.2.2-1 TCS State Diagram

Upon application of power the TCS Core Functionality CSCI shall insure that the TCS safely enters the Startup State. (SSS016)[SSDD265]

The Startup State shall be comprised of the following modes: Normal Startup Mode, and Recovery Startup Mode. (SSS017)[SSDD266]

Figure 4.1.2.2-2 shows the modes that exist in the Start up State.

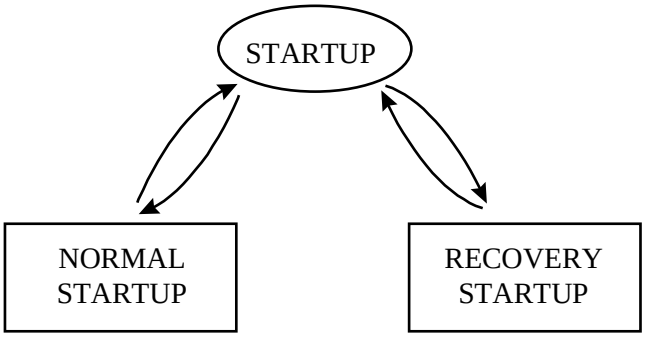

Figure 4.1.2.2-2 TCS Startup State and Associated Modes Diagram

When the TCS is terminated normally the TCS Core Functionality CSCI shall enter the Normal Startup Mode of operation upon application of power. (SSS019)[SSDD267]

When the TCS is halted due to an unplanned power interruption or abnormal program termination, TCS shall enter the Recovery Startup Mode upon the next startup cycle. (SSS020)] [SSDD268]

During startup, the TCS Core Functionality CSCI shall determine which of the 5 levels of interaction are achievable by the TCS configuration being used. (SSS021)] [SSDD269]

When executing in the Normal Start-up Mode, the TCS Core Functionality CSCI shall provide the system functionality necessary to execute the Start-up Fault Detection / Location (FD/L) and initialize the system to place it in the UAV independent Operations State within 60 seconds. (SSS024)] [SSDD270

When executing in the Normal Start-up Mode, the TCS Core Functionality CSCI shall include startup of the TCS HWCIs (SSS542)[SSDD271], as necessary downloading of software (SSS026) [SSDD272], activation of CSCIs (SSS027) [SSDD273], execution of Startup FD/L (SSS025)[SSDD274], and establishment of the state of readiness of all interfaces (SSS028)[SSDD275)], and any additional actions required for the TCS to enter the Operations State.

When executing in the Recovery Startup Mode, the TCS Core Functionality CSCI shall be capable of resuming normal operations, with all parameters set to the last valid values stored on the Hard disk, within 45 seconds of receiving transition to Normal Mode. (SSS029)[SSDD276)]

When executing in the Recovery Startup Mode, the TCS Core Functionality CSCI shall include startup of TCS HWCIs (SSS543)[SSDD277], as necessary downloading of software (SSS544) [SSDD278], activation of CSCIs (SSS545)[SSDD279], and establishment of the state of readiness of all interfaces (SSS546)[SSDD280], and any additional actions required for the TCS to enter the Operations State.

For recovery from abnormal termination periods of less than a programmable time (T1), the TCS Core Functionality CSCI shall resume the previous Operations State and associated functions, using the last valid data stored prior to the abnormal termination. (SSS030) [SSDD281]

For recovery from abnormal termination periods of greater than time T1, the TCS Core Functionality CSCI shall prompt the operator via the Work Station Console to select the type of recovery to be executed: (1)Resume In The Same Modes And Data; (SSS031)[SSDD282] (2)Resume in the Same Modes but Review and Modify the Command Data as Necessary (SSS031)[SSDD283]; or (3) Perform a Command Shutdown and Startup Via the Normal Startup Mode.(SSS031)[SSDD284]

When in the Operations State the TCS Core Functionality CSCI shall provide a minimum of three modes: normal operations mode, training operations mode, and maintenance operations mode. (SSS032)[SSDD285]

Figure 4.1.2.2-3 shows the Mode Diagram for the Operations State of TCS.

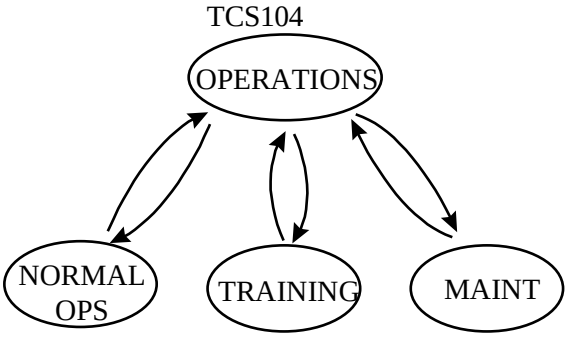

Figure 4.1.2.2-3 TCS Operations State and Associated Modes Diagram

The TCS Core Functionality CSCI shall provide the operator, via the Work Station Console, with the capability to command the system to the shutdown state from all modes under the Operations State. (SSS035)[SSDD286]

Upon the reception of a shutdown command, the TCS Core Functionality CSCI shall enter the Shutdown State within TBD seconds, which will cause the TCS to be placed in a condition where power can be removed without impacting operations or causing damage to the system, and from which restart of the system can be accomplished normally. (SSS043)[SSDD287]]

The TCS Core Functionality CSCI shall ensure that shutdown of the TCS include storage or deletion, as specified by the operator, of mission data files (SSS044)[SSDD288], shutdown of appropriate functions (SSS045) [SSDD289], shutdown of the TCS HWCIs (SSS046) [SSDD290], and proper termination of all active interfaces (SSS047)[SSDD291].

The TCS Core Functionality CSCI shall activate Startup FD/L as part of normal Start-up Mode. (SSS250)[SSDD292]

The TCS Core Functionality CSCI shall provide the processing capability to exercise FD/L as part of normal Start-up Mode. (SSS250) [SSDD293]

Start-up FD/L processing provided by the TCS Core Functionality CSCI shall exercise the TCS Configuration Items so that a minimum fault detection of TBD% of all mission critical failures with a false alarm rate not to exceed TBD% is provided. (SSS254)[SSDD294]

Startup FD/L processing provided by the TCS Core Functionality CSCI shall isolate TBD% of all detected mission critical failures to a single LRU. (SSS255) [SSDD295]

The remaining mission critical failures detected but not isolated by Start-up FD/L shall be isolated using manual isolation procedures and technical data provided to the operator by the TCS Core Functionality CSCI. (SSS256) [SSDD296]

Likewise, Start-up FD/L in the TCS Core Functionality CSCI shall fault detect TBD% of all non-mission critical failures with a false alarm rate not to exceed TBD%. (SSS257) [SSDD297]

Start-up FD/L in the TCS Core Functionality CSCI shall isolate TBD% of all detected non-mission

critical failures to a single LRU. (SSS258) [SSDD298]

The remaining non-mission critical failures detected but not isolated by Start-up FD/L shall be isolated using manual isolation procedures and technical data provided to the Operator(s) by the TCS. Core Functionality CSCI (SSS259) [SSDD299]

4.1.2.2.2 TCS Main

The following TCS requirements are allocated to the TCS Main element of the TCS Core Functionality CSCI:

- Support scaleability to meet user's level of interaction needs.
- Prevent users from entering interaction levels not supported by the available HW configuration.
- Activities and Processes Log.
- HCI Requirements.

The TCS Core Functionality CSCI shall prohibit levels of interaction higher than that achievable by a particular TCS configuration. (SSS022) [SSDD300]

The TCS Core Functionality CSCI shall inform the operator if the operator attempts to execute a function that is prohibited based upon the determined level of interaction. (SSS023)[SSDD301]

The TCS Core Functionality CSCI shall periodically receive and process the results of periodic Fault Detection/Location (FD/L) from the Maintenance element of the TCS Core Functionality CSCI, while in the Normal Operations Mode and Training Mode. (SSS036) [SSDD302]

The TCS Core Functionality CSCI shall periodically determine the level of interactions that TCS can support. (SSS036)[SSDD303]

The TCS Core Functionality CSCI shall have the functionality to receive status information from the C4I Interfaces CSCI to determine C4I interaction availability. (SSS239) [SSDD304]

The TCS Core Functionality CSCI shall restrict the operator(s) from exercising levels of interaction not achievable by the system. (SSS403) [SSDD305]

4.1.2.2.3 AV Control

The following TCS requirements are allocated to the AV Control element of the TCS Core Functionality CSCI:

- Generic and Specific safety of flight processing.

- Dynamic Inflight Mission Plan Modification.
- Support for multiple AV systems and the five levels of interaction.
- AV Hand-Off.
- HCI Requirements.

While simultaneously flying two AVs of different types, the TCS Core Functionality CSCI shall provide full automated control functionality for each AV. (SSS108) [SSDD306]

The TCS Core Functionality CSCI shall have the capability to sequentially control multiple AVs. (SSS112) [SSDD307]

The TCS Core Functionality CSCI shall provide the capability to pass control of an AV to another TCS or AV specific GCS (SSS114) [SSDD308], or take control of an AV from another TCS or AV specific GCS. (SSS115) [SSDD309]

The TCS Core Functionality CSCI flight controls shall provide for operator command and for autonomous control with operator override. (SSS118) [SSDD310]

The TCS Core Functionality CSCI shall provide the capability to control the flight of the selected AV in accordance with the specific AV's operational performance capabilities. (SSS120) [SSDD311]

The TCS Core Functionality CSCI shall provide the capability to enter AV preset limits which, as a minimum, will include airspeed limits, altitude limits, and fuel limits. (SSS122) [SSDD312]

The TCS Core Functionality CSCI shall only support operation of the AV via autopilot flight modes, and will not provide the operator the capability to directly manipulate AV flight surfaces. (SSS126) [SSDD313]

The TCS Core Functionality CSCI shall provide interactive displays necessary to command the flight of an AV. (SSS127) [SSDD314]

The TCS Core Functionality CSCI shall allow the operator to control the flight behavior characteristics inherent to the selected AV. (SSS128) [SSDD315]

Table 4.1.2.2.3-1 shows the expected flight behavior characteristics for known and future UAVs.

Table 4.1.2.2.3-1 UAV Flight Behavior Characteristics

FLIGHT BEHAVIOR CHARACTERISTICS	UAV
Heading	Predator
Airspeed	
Altitude	

FLIGHT BEHAVIOR CHARACTERISTICS	UAV
Weight	
Time on Station	
Fuel Load	
Heading	Outrider
Airspeed	
Altitude	
Weight	
Time on Station	
Fuel Load	
	Future

The TCS Core Functionality CSCI shall provide the operator the capability to initiate or change flight behaviors by sending the proper control commands to the AV. (SSS129) [SSDD316]

The TCS Core Functionality CSCI shall have the capability to command the AV to use the navigation methods inherent to the selected AV. (SSS130) [SSDD317)]

Table 4.2.2.2.3-2 shows the expected navigation methods for known and future AVs.

Table 4.1.2.2.3-2 UAV Navigation Methods

NAVIGATION METHOD	UAV
Inertial Navigation System (INS)	Predator
Global Positioning System (GPS)	Predator
GPS	Outrider
Integrated INS/GPS	Future

The TCS Core Functionality CSCI shall provide the operator the capability to initiate or change AV

navigation methods by sending the proper control commands to the AV. (SSS131) [SSDD318]

The TCS Core Functionality CSCI shall support an automatic launch and recovery system. (SSS135) [SSDD319]

The TCS Core Functionality CSCI shall be interoperable with the Integrity Beacon Landing System (IBLS) (SSS136) [SSDD320], and the Common Automated Recovery System (CARS) (SSS137) [SSDD321].

The TCS Core Functionality CSCI shall present sufficient cues to the operator to implement and monitor automatic launch and recovery, and to initiate abort procedures if required. (SSS138) [SSDD322]

The TCS Core Functionality CSCI shall allow the operator to initiate the emergency recovery feature of the AV, if the AV has an emergency recovery feature. (SSS139) [SSDD323]

Upon operator initiation the emergency recovery feature of the AV, the TCS Core Functionality CSCI shall verify that the AV received the emergency recovery instructions and is acting appropriately. (SSS139) [SSDD324]

When the AV fails to respond appropriately to the emergency recovery command within TBD seconds the TCS Core Functionality CSCI shall notify the operator within TBD milliseconds. (SSS139)[SS325]

The TCS Core Functionality CSCI shall provide sufficient cues to allow the operator to safely navigate the AV while inflight using instrumentation designed to meet Instrument Flight Rules. (SSS347) [SSDD326]

The TCS Core Functionality CSCI shall provide sufficient displays to allow the operator to operate each AV within its certified operational flight envelope. (SSS348) [SSDD327]

The TCS Core Functionality CSCI shall provide the capability for appropriate caution(s) to be provided to the operator when the air vehicle is approaching an unsafe flight regime. (SSS349) [SSDD328]

The TCS Core Functionality CSCI shall generate sufficient cautions and warnings to alert the operator if the air vehicle deviates into unsafe flight regime. (SSS349) [SSDD329]

The TCS Core Functionality CSCI shall generate sufficient cautions and warnings to alert the operator when the AV system has identified a malfunction. (SSS351) [SSDD330]

The TCS Core Functionality CSCI shall provide the required information to allow the operator to maintain safe separation from other aircraft and a safe altitude in civilian airspace per Federal Aviation Administration (FAA) rules. (SSS352) [SSDD331]

The TCS Core Functionality CSCI shall be designed such that no single software error results in an unsafe command to be transmitted to the air vehicle. (SSS556) [SSDD332]

The TCS Core Functionality CSCI shall provide the capability to implement an emergency action plan, if supported by the AV, to control the AV during equipment failures.(SSS539) [SSDD333]

Upon operator initiation the emergency action plan of the AV, the TCS Core Functionality CSCI shall verify that the AV received the emergency action instructions and is acting appropriately. (SSS539) [SSDD334]

When the AV fails to respond appropriately to the emergency action plan within TBD seconds the TCS Core Functionality CSCI shall notify the operator. (SSS539) [SSDD335]

4.1.2.2.4 AV Flight Monitoring

The following TCS requirements are allocated to the AV Flight Monitoring element of the TCS Core Functionality CSCI:

- Generic and Specific safety of flight processing.
- AV Caution/Warning/Alerts and operator response Log.
- Logging all information sent to an AV.
- Logging all data received from an AV.
- HCI Requirements.

While simultaneously flying two AVs of different types, the TCS Core Functionality CSCI shall monitor each AV at an alternating rate of TDB seconds to perform error analysis and issue warnings when necessary. (SSS108) [SSDD336]

The TCS Core Functionality CSCI shall have the capability to sequentially monitor multiple AVs. (SSS112) [SSDD337]

The TCS Core Functionality CSCI shall notify the operator when AV performance parameters are out of limits. (SSS113) [SSDD338]

The TCS Core Functionality CSCI shall provide the capability to monitor the status of all AV subsystems reporting status. (SSS142) [SSDD339]

The TCS Core Functionality CSCI shall display the AV status, to include but not be limited to the AV location and system status. (SSS143) [SSDD340]

While the data link is not operational, the TCS Core Functionality CSCI shall present the last known AV status values and the time at which the last values were reported. (SSS144) [SSDD341]

The TCS Core Functionality CSCI shall be capable of displaying the fuel parameters to the operator to include as a minimum, fuel status, flow rate, and bingo fuel. (SSS145) [SSDD342]

The TCS Core Functionality CSCI shall provide sufficient cues to allow the operator to safely

monitor the AV while inflight using instrumentation designed to meet Instrument Flight Rules. (SSS347) [SSDD343]

4.1.2.2.5 Datalink Management and Control

The following TCS requirements are allocated to the System Status element of the TCS Core Functionality CSCI:

- Generic and specific Datalink processing (TCS Datalink Terminal and Air Datalink Terminal Control and Monitoring).
- Frequency management.
- Datalink Channel management.
- AV ADT and GDT antenna control.
- HCI Requirements.

The TCS Core Functionality CSCI shall provide the capability to control automatic switching to a SATellite COMmunication (SATCOM) antenna, if the selected AV has SATCOM capability, when the AV proceeds beyond LOS range or when LOS is obstructed. (SSS117) [SSDD344]

The TCS Core Functionality CSCI shall provide the operator the capacity to fully control the AV's Identification Friend or Foe (IFF).)SSS121) [SSDD345]

The TCS Core Functionality CSCI shall allow the operator to control an AV using the LOS or SATCOM datalinks. (SSS124) [SSDD346]

The TCS Core Functionality CSCI shall provide for air vehicle flight control beyond line of sight via uplink command for a minimum of two air vehicles of the same type using sequential communication techniques. (SSS125) [SSDD347] Sequential communication means alternatively communicating with one air vehicle and then the other. Current air vehicle design does not permit concurrent communications with two air vehicles at the same time.

The TCS Core Functionality CSCI shall provide the functionality to control, monitor, and display the operation of the Air Data Terminal (ADT). (SSS132) [SSDD348] Control will include control of the ADT antenna (SSS133) [SSDD349] and of the ADT transmitter and receiver signal strength and frequencies used by ADT for data link communication. (SSS134) [SSDD350]

The TCS Core Functionality CSCI shall provide the ability for payload control beyond line of sight via uplink command of two air vehicles of the same type using a sequential communication technique. (SSS149) [SSDD351] Sequential communication means alternatively communicating with one air vehicle and then the other. Current air vehicle design does not permit concurrent communications with two air vehicles at the same time.

The TCS Core Functionality CSCI shall have the capability to control and monitor a line-of-sight or

satellite datalink terminal. (SSS158) [SSDD352]

The TCS Core Functionality CSCI control of the datalink terminal shall include, but not be limited to, antenna pointing control, transmitter control, and receiver control. (SSS160) [SSDD353]

For a previously selected datalink terminal, the TCS Core Functionality CSCI shall be capable of automatically selecting one of the following LOS Data Terminal Modes of operation:

1. acquisition, (SSS161) [SSDD354]
2. autotrack, (SSS161) [SSDD355]
3. search, (SSS161) [SSDD356]
4. manual point, (SSS161) [SSDD357]
5. omni directional, (SSS161) [SSDD358] and
6. directional (SSS161) [SSDD359]

if applicable to the selected datalink.

The TCS Core Functionality CSCI shall provide the capability for operator to be able to manually override any automatic datalink terminal control mode selection. (SSS163) [SSDD360]

The TCS Core Functionality CSCI shall support a sequential LOS datalink and beyond LOS datalink capability. (SSS164) [SSDD361]

The TCS Core Functionality CSCI shall provide an interactive display for the purpose of control and monitoring of the data link terminal. (SSS165) [SSDD362]

The TCS Core Functionality CSCI shall be capable of providing commands that direct the datalink terminal to automatically point the directional antenna(s). (SSS167) [SSDD363]

The TCS Core Functionality CSCI shall provide the operator the ability to manually point the directional antenna(s). (SSS168) [SSDD364]

The TCS Core Functionality CSCI shall be capable of properly selecting and positioning antennas to maintain line-of-sight or satellite communication. (SSS170) [SSDD365]

The TCS Core Functionality CSCI shall be capable of providing commands that direct the datalink terminal to automatically control the transmitter and receiver functions of the selected datalink terminal. (SSS171) [SSDD366]

The TCS Core Functionality CSCI shall provide the operator the ability to manually override the automatic function selection of the selected datalink terminal. (SSS172) [SSDD367]

The TCS Core Functionality CSCI shall be capable of providing commands that direct the datalink terminal to automatically control the transmitter and receiver modes of the selected datalink terminal. (SSS173) [SSDD368]

The TCS Core Functionality CSCI shall provide the operator the ability to manually override the

automatic mode selection of the selected datalink terminal. (SSS174) [SSDD369]

The TCS Core Functionality CSCI shall be capable of providing commands that direct the datalink terminal to automatically control the transmitter and receiver frequencies of the selected datalink terminal. (SSS175) [SSDD370]

The TCS Core Functionality CSCI shall provide the operator the ability to manually select the transmitter and receiver frequency selections. (SSS176) [SSDD371]

The TCS Core Functionality CSCI shall receive, process, and present status data to the operator to monitor the status of the datalink terminal and the supported AV data link. (SSS177) [SSDD372]

The TCS Core Functionality CSCI shall be capable of monitoring and displaying the signal strength of the received and transmitted signals for the selected datalink terminal. (SSS178) [SSDD373]

The TCS Core Functionality CSCI shall be capable of monitoring and displaying the signal quality of the received and transmitted signals for the selected datalink terminal. (SSS179) [SSDD374]

The TCS Core Functionality CSCI shall be capable of presenting to the operator a visual depiction of the minimum and maximum data link operational ranges. (SSS180) [SSDD375]

The TCS Core Functionality CSCI shall support a concurrent uplink and downlink capability regarding the transmission of AV commands and reception of AV telemetry and status. (SSS325)] [SSDD376]

The TCS Core Functionality CSCI shall support a concurrent uplink and downlink capability regarding the transmission of payload commands and reception of payload data and status. (SSS325)] [SSDD377]

The TCS Core Functionality CSCI shall monitor the uplink and downlink to each AV under its control. (SSS355) [SSDD378]

Upon detection of loss of link, the TCS Core Functionality CSCI shall issue the proper commands to attempt to re-establish communications with the air vehicle. (SSS356) [SSDD379]

The TCS Core Functionality CSCI shall provide unambiguous AV control and status feedback indicators to ensure safe, efficient operations of two AVs by a single TCS. (SSS475) [SSDD380]

4.1.2.2.6 EO/IR Payload Control

The following TCS requirements are allocated to the EO/IR Payload Control element of the TCS Core Functionality CSCI:

- Generic and specific Reconnaissance processing.
- Dynamic inflight Payload Plan Modifications.
- HCI Requirements.

The TCS Core Functionality CSCI shall be interoperable with EO/IR Payloads. (SSS013) [SSDD381]

The TCS Core Functionality CSCI shall have the capability to control and monitor the EO/IR payload. (SSS147) [SSDD382]

The TCS Core Functionality CSCI shall have the capability to control payloads on an AV that is being controlled from another TCS. (SSS148) [SSDD383]

The TCS Core Functionality CSCI shall permit the operator to control the payload using the methods supported by the payload being controlled. (SSS152) [SSDD384]

Table 4.1.2.2.6-1 defines the payload control methods to be supported for the candidate AVs.

Table 4.1.2.2.6-1 Payload Control Methods

PAYLOAD TYPE	CONTROL METHOD
EO/IR	Point to Coordinate
	Hold on Coordinates
	Auto-Track
	Auto-Search

The TCS Core Functionality CSCI shall respond appropriately to commands received from the operator to override payload automated or preprogrammed inputs. (SSS154) [SSDD385]

The TCS Core Functionality CSCI shall provide coarse and fine payload control capabilities directly on the payload screen. (SSS478) [SSDD386]

4.1.2.2.7 EO/IR Imagery Viewer

The following TCS requirements are allocated to the EO/IR Imagery Viewer element of the TCS Core Functionality CSCI:

- EO/IR Image viewing.
- Airborne VCR Control processing.
- TCS VCR and Video Support processing.

- HCI Requirements

The TCS Core Functionality CSCI shall have the functionality to process payload product data from Electro Optical (EO) and Infrared (IR) payloads. (SSS182) [SSDD387]

The TCS Core Functionality CSCI shall be able to store up to 24 hours of EO/IR payload imagery an associated telemetry data. (SSS184) [SSDD388]

The TCS Core Functionality CSCI shall have a built-in word processing and text capability including the ability to annotate textual information on imagery. (SSS187) [SSDD389]

The TCS Core Functionality CSCI shall be capable of receiving HAE UAV payload imagery. (SSS188) [SSDD390]

The TCS Core Functionality CSCI shall provide the functionality that allows the operator to correlate, format, and internally route the EO/IR video imagery. (SSS190) [SSDD391]

The TCS Core Functionality CSCI shall interface with the Video Support, VCR, and Printer to provide the operator with the capability to record the video (SSS190) [SSDD392], capture and store a freeze frame of the video (SSS191) [SSDD393], retrieve and display the video (SSS192) [SSDD394], print out a hard copy of freeze frame imagery (SSS193) [SSDD395], and process digital imagery for export and dissemination (SSS194) [SSDD396].

The TCS Core Functionality CSCI shall display live and recorded imagery data, with as well as without annotation and overlay, upon operator request. (SSS195) [SSDD397]

The TCS Core Functionality CSCI operator shall be able to select the content of the overlay information. (SSS196) [SSDD398]

The TCS Core Functionality CSCI shall have the capability to insert or remove cross hairs (or other similar Icons) to identify objects in the imagery viewer. (SSS197) [SSDD399]

Upon operator request, the TCS Core Functionality CSCI shall allow RS170A Video and digital imagery to be routed to the imagery viewer for display. (SSS198) [SSDD400]

The TCS Core Functionality CSCI shall interface with the Video Support HWCI to perform limited exploitation on the payload product data. (SSS200) [SSDD401] Limited exploitation, as a minimum, will include image enhancement, annotation, graphic overlay, and voice and textual reporting for spot and mission objectives.

The TCS Core Functionality CSCI image enhancement capabilities shall include contrast, brightness, edge enhancement, and sharpness. (SSS201) [SSDD402]

The TCS Core Functionality CSCI shall interface with the Video Support HWCI to provide the capability to capture frozen-frames of imagery. (SSS202) [SSDD403]

The TCS Core Functionality CSCI shall provide the commands to store the frozen-frames of imagery for further review and processing. (SSS202) [SSDD404]

The TCS Core Functionality CSCI shall have the capability to display Near-Real Time (NRT) imagery with overlays to include, as a minimum, date/time group, target location coordinates when the target is in the center of the field of view, north seeking arrow, and AV position and heading. (SSS203) [SSDD405]

The TCS Core Functionality CSCI shall have the functionality to provide the following analog data processing capability:

1. Prepare annotated as well as unannotated analog imagery for transmission (SSS237) [SSDD406]

2. Receive incoming annotated as well as unannotated analog imagery (SSS238) [SSDD407]

3. View incoming and outgoing, annotated as well as unannotated analog imagery (SSS243) [SSDD408]

4. View incoming and outgoing, annotated as well as unannotated digital imagery messages (SSS244) [SSDD409]

The TCS Core Functionality CSCI shall allow the operator to fully control the VCR via the Work Station Console Display. (SSS334) [SSDD410]

The TCS Core Functionality CSCI shall provide unambiguous payload control and status feedback indicators to ensure safe, efficient operations of the payloads on two AVs. (SSS475) [SSDD411]

The TCS Core Functionality CSCI shall provide the capability to lock onto and hold a coordinate point in-the imagery screen. (SSS481) [SSDD412]

The TCS Core Functionality CSCI shall provide for the capability to automatically overlay designated target locations from the payload screen onto the map screen. (SSS490) [SSDD413]

The TCS Core Functionality CSCI shall provide the capability to compute the range and bearing between two geographic positions located on the payload imagery display. (SSS560) [SSDD414]

4.1.2.2.8 EO/IR Imagery Data Acquisition

The following TCS requirements are allocated to the EO/IR Imagery Data Acquisition element of the TCS Core Functionality CSCI:

- EO/IR Image (and Telemetry) Acquisition.
- EOIR Product Manipulation and Management processing (in conjunction with the DII Imagery Services).
- HCI Requirements

The TCS Core Functionality CSCI shall have the capability to receive data from payloads on an AV that is being controlled from another TCS. (SSS148) [SSDD415]

The TCS Core Functionality CSCI shall receive, process, and present payload data to the operator so that the status of the payload can be determined. (SSS151) [SSDD416]

The TCS Core Functionality CSCI shall have the functionality to process payload product data to include correlating, formatting, storing, and internally routing payload information. (SSS182) [SSDD417]

The TCS Core Functionality CSCI shall provide the processing and control with the respective storage HWCI(s) to be able to store up to 24 hours of payload data. (SSS184) [SSDD418]

4.1.2.2.9 C4I Messages

The following TCS requirements are allocated to the C4I Messages element of the TCS Core Functionality CSCI:

- Generation of C4I data messages.
- Dissemination to C4I users.
- External Data Storage processing.
- HCI Requirements.

The TCS Core Functionality CSCI shall make AV telemetry data available to support the development of C4I tactical communication messages. (SSS119) [SSDD419]

The TCS Core Functionality CSCI shall make Payload telemetry data available to support the development of C4I tactical communication messages. (SSS189) [SSDD420]

TCS Core Functionality CSCI shall be capable of receiving information flagging erroneous messages that cannot be corrected by the C4I Interfaces CSCI. (SSS235) [SSDD421]

For external communications to tactical C4I systems, the TCS Core Functionality CSCI shall utilize an Application Programming Interface (API) to deliver tactical data to the C4I Interface CSCI and the Tactical Communications (TACCOM) software modules. (SSS290) [SSDD422]

As a minimum, the tactical data developed by the TCS Core Functionality CSCI shall be presented to the TACCOM API in a format prescribed by and acceptable to the following Tactical Fire (TACFIRE) messages:

1. Reconnaissance Exploitation Report (RECCEXREP) (SSS220) [SSDD423
2. Size, Activity, Location, Unit, Time, and Equipment Report (SALUTE) (SSS220) [SSDD424]
3. Artillery Target Intelligence; Coordinate Report (ATI;CDR)] (SSS220) [SSDD425

The TCS Core Functionality CSCI shall have the functionality to provide the following data monitoring capability:

1. Display which C4I systems are supported and online during a mission (SSS240) [SSDD426]

2. Review all tactical communication messages received and transmitted (SSS242) [SSDD427]

The TCS Core Functionality CSCI shall coordinate the routing of VCR recorded payload video to the C4I Interfaces. (SSS335) [SSDD428]

4.1.2.2.10 NITF Files

The following TCS requirements are allocated to the NITF Files element of the TCS Core Functionality CSCI:

- Generation of C4I digital imagery and data messages.
- Dissemination to C4I users.
- External Data Storage processing.
- HCI Requirements.

The TCS Core Functionality CSCI shall make AV telemetry data available to support the development of NITF 2.0 files. (SSS119) [SSDD429]

The TCS Core Functionality CSCI shall be in compliance with Common Imagery Ground Surface Station (CIGSS), United States Imagery Standards (USIS), National Imagery Transmission Format (NITF) Version 2.0 and Global Command Control Systems (GCCS) when processing payload imagery data. (SSS1850 [SSDD430]

The NITF 2.0 imagery files generated by TCS Core Functionality CSCI shall contain the necessary telemetry and support data to permit subsequent imagery exploitation by C4I systems. (SSS186) [SSDD431]

The TCS Core Functionality CSCI shall be capable of receiving HAE UAV payload imagery in the form of NITF 2.0 files. (SSS188) [SSDD432]

The TCS Core Functionality CSCI shall make Payload telemetry data available to support the development of NITF 2.0 files. (SSS189) [SSDD433]

4.1.2.2.11 Targeting

The following TCS requirements are allocated to the Targeting element of the TCS Core

Functionality CSCI:

- Accurate target coordinate Acquisition and development (Multiple Image Coordinate Extraction (MICE) and/or NIDAL software).
- Target location error analysis.
- HCI Requirements.

The TCS Core Functionality CSCI shall make AV telemetry data available to support the development of accurate target coordinates. (SSS119) [SSDD434]

The TCS Core Functionality CSCI shall make Payload telemetry data available to support the development of accurate target coordinates. (SSS189) [SSDD435]

The TCS Core Functionality CSCI shall support a target location function where the operator can request the current ground location of the payload field-of-view center. (SSS206) [SSDD436]

The TCS Core Functionality CSCI shall have the functionality to determine the location of items of interest within the payload field of view, and express these locations in coordinates acceptable for military applications. (SSS207) [SSDD437]

The TCS Core Functionality CSCI shall have the functionality to develop an estimate of the error in computed target coordinates, and associate the error estimate with the appropriate target. (SSS2080 [SSDD438]

4.1.2.2.12 Collection Tasking and Retasking

The following TCS requirements are allocated to the Collection Tasking and Retasking element of the TCS Core Functionality CSCI:

- Support tasking and retasking requests.
- Log requests.
- HCI Requirements

The TCS Core Functionality CSCI shall permit the operator(s) to dynamically perform mission retasking during all phases of operational mission execution. (SSS067) [SSDD439]

The TCS Core Functionality CSCI shall make AV telemetry data available to support mission retasking efforts. (SSS119) [SSDD440]

The TCS Core Functionality CSCI shall make Payload telemetry data available to support mission retasking efforts. (SSS189) [SSDD441]

4.1.2.2.13 Launch and Recovery

The following TCS requirements are allocated to the System Status element of the TCS Core Functionality CSCI:

- Generic and specific Launch and Recovery processing.
- Support for Automated Launch and Recovery System.
- HCI Requirements

The TCS Core Functionality CSCI shall support an automatic launch and recovery system. (SSS1350 [SSDD442]

The TCS Core Functionality CSCI shall be interoperable with the Integrity Beacon Landing System (IBLS) (SSS136([SSDD443], and the Common Automated Recovery System (CARS) (SSS1370 [SSDD444].

The TCS Core Functionality CSCI shall present sufficient cues to the operator to implement and monitor automatic launch and recovery, and to initiate abort procedures if required. (SSS138) [SSDD445]

The TCS Core Functionality CSCI shall provide sufficient cues to allow the operator to safely monitor AV take-off and landing using instrumentation designed to meet Instrument Flight Rules. (SSS347) [SSDD446]

4.1.2.2.14 Training

The following TCS requirements are allocated to the Training element of the TCS Core Functionality CSCI:

- Provides for Initial Training on all TCS Components as well as periodic re-certification.
- Provides for computer based training.
- Training Evaluation Processing.
- HCI Requirements.

The TCS Core Functionality CSCI training capability shall be alterable without affecting the configuration of the operational software. (SSS402) [SSDD447]

The TCS Core Functionality CSCI shall provide a high resolution computer generated graphical user interface, that enables the UAV operator that is trained on one system to be to control different types of UAV as well as UAV payloads with minimal additional training. (SSS404) [SSDD448]

The TCS Core Functionality CSCI training capability shall provide, for the operator and maintainer, an embedded or add-on interactive training courseware with self-paced instruction, duplicating UAV flight performance characteristics, capabilities, and limitations. (SSS492) [SSDD449]

The TCS Core Functionality CSCI training capability shall be compatible with the U.S. Army Intelligence and Electronic Warfare Tactical Proficiency Trainer as an objective. (SSS493) [SSDD450]

The TCS Core Functionality CSCI training capability shall not support formal training operations concurrent with the execution of an actual mission. (SSS499) [SSDD451] The capability for the conduct of actual communications processing concurrently with training operations shall be provided if and only if messages are identified as training messages. (SSS500) [SSDD452]

The TCS Core Functionality CSCI shall record operator and maintainer actions for self assessment and performance enhancement. (SSS502) [SSDD453]

The TCS Core Functionality CSCI shall record and make retrievable parameters that can be utilized to measure operator and maintainer performance. (SSS503) [SSDD454]

4.1.2.2.15 Maintenance

The following TCS requirements are allocated to the Maintenance element of the TCS Core Functionality CSCI:

- Periodic and Extensive Fault Detection/Location processing.
- Maintenance processing.
- Contribution to Logistic Databases.
- Interactive Electronic Technical Manuals.
- Software Debug and Monitoring processing.
- HCI Requirements

The TCS Core Functionality CSCI shall perform periodic Fault Detection/Location (FD/L) on the TCS Computer HWCIs while in the Normal Operations Mode and Training Mode. (SSS036) [SSDD455]

The TCS Core Functionality CSCI shall periodically provide Fault Detection/Location (FD/L) status to TCS Main element of the TCS Core Functionality CSCI, while in the Normal Operations Mode and Training Mode, for purposes of determining the level of interaction maintainable by the available HWCIs. (SSS036) [SSDD456]

The TCS Core Functionality CSCI shall be capable of executing each of the AV specific maintenance software packages and displaying the appropriate results. (SSS245) [SSDD457]

The TCS Core Functionality CSCI shall be capable of executing each of the payload specific maintenance software packages and displaying the appropriate results. (SSS246) [SSDD458]

The TCS Core Functionality CSCI shall be capable of executing each of the datalink terminal specific maintenance software packages and displaying the appropriate results. (SSS247) [SSDD459]

The TCS Core Functionality CSCI shall be capable of executing workstation and peripheral equipment maintenance software and displaying appropriate status results. (SSS248) [SSDD460]

The TCS Core Functionality CSCI shall provide processing capability to exercise FD/L periodically during Normal Operations and Training Modes, and extensively, if selected, as part of Maintenance Mode. (SSS250) [SSDD461]

The TCS Core Functionality CSCI shall provide the operator the ability to control and monitor the AV's FD/L (SSS251) [SSDD462]

The TCS Core Functionality CSCI shall provide the operator the ability to control and monitor the Payload's FD/L. (SSS252) [SSDD463]

The TCS Core Functionality CSCI shall provide the operator the ability to control and monitor the Data Link FD/L. (SSS253 [SSDD464]

Periodic FD/L processing provided by the TCS Core Functionality CSCI shall fault detect TBD% of all mission critical failures with a false alarm rate not to exceed TBD%. (SSS260) [SSDD465]

Periodic FD/L processing provided by the TCS Core Functionality CSCI shall isolate TBD% of all detected mission critical failures to a single LRU. (SSS261) [SSDD466]

The remaining mission critical failures detected but not isolated by Periodic FD/L shall be isolated using manual isolation procedures and technical data provided to the operator by the TCS Core Functionality CSCI. (SSS262) [SSDD467]

Likewise, Periodic FD/L processing provided by the TCS Core Functionality CSCI shall fault detect TBD% of all non-mission critical failures with a false alarm rate not to exceed TBD%. (SSS263) [SSDDD468] Periodic FD/L shall isolate TBD% of all detected non-mission critical failures to a single LRU. (SSS264) [SSDD469]

The remaining non-mission critical failures detected but not isolated by Periodic FD/L shall be isolated using manual isolation procedures and technical data provided to the Operator(s) by the TCS Core Functionality CSCI. (SSS265) [SSDD470]

Periodic FD/L processing provided by the TCS Core Functionality CSCI shall never take longer than TBD minutes to execute (SSS266) [SSDD471] and shall continuously operate in the background while the system is in the Operations state.(SSS267) [SSDD472]

Extensive FD/L processing provided by the TCS Core Functionality CSCI shall fault detect TBD% of all mission critical failures with a false alarm rate not to exceed TBD%. (SSS268) [SSDD473]

Extensive FD/L processing provided by the TCS Core Functionality CSCI shall isolate TBD% of all detected mission critical failures to a single LRU. (SSS269) [SSDD474]

The remaining mission critical failures detected but not isolated by Extensive FD/L shall be isolated using manual isolation procedures and technical data provided to the operator by the TCS Core

Functionality CSCI. (SSS270) [SSDD475]

Likewise, Extensive FD/L processing provided by the TCS Core Functionality CSCI shall fault detect TBD% of all non-mission critical failures with a false alarm rate not to exceed TBD%. (SSS271) [SSDD476]

Extensive FD/L processing provided by the TCS Core Functionality CSCI shall isolate TBD% of all detected non-mission critical failures to a single LRU. (SSS272) [SSDD477]

The remaining non-mission critical failures detected but not isolated by Extensive FD/L shall be isolated using manual isolation procedures and technical data provided to the Operator(s) by the TCS Core Functionality CSCI. (SSS273) [SSDD478]]

Extensive FD/L processing provided by the TCS Core Functionality CSCI shall allow the operator(s) to select specific tests or all test for execution. (SSS274) [SSDD479]

Extensive FD/L processing provided by the TCS Core Functionality CSCI shall inform the operator(s) how long a specific test will take and periodically, at least once every TBD seconds, delineate the estimated time till completion. (SSS275) [SSDD480]

The TCS Core Functionality CSCI shall allow Authorized Operators to install software upgrades via CD-ROM or other media storage devices. (SSS276) [SSDD481] The TCS Core Functionality CSCI shall restrict Operator access to this capability via password protection. (SSS277) [SSDD482]

The TCS Core Functionality CSCI shall provide the capability for Authorized Operators to modify all TCS software programmable parameters. (SSS278) [SSDD483] As a minimum, The TCS Core Functionality CSCI shall restrict Operator access to this capability via password protection. (SSS279) [SSDD484]

The TCS Core Functionality CSCI shall allow an Authorized Operator to execute a software debug capability and view the resulting debug diagnostic information. (SSS282) [SSDD485] As a minimum, the TCS Core Functionality CSCI shall restrict Operator access to this capability via password protection.(SSS283)[SSDD486]

4.1.2.3 TCS Mission Planner CSCI

The TCS Mission Planner CSCI will consist of the following basic elements:

1. Route Planner
2. Payload Planner
3. Datalink Planner
4. Communications Planner
5. Plan Monitoring
6. Training
7. Maintenance

The TCS Mission Planner CSCI shall have the functionality to allow the operator Console to generate a AV mission plan. (SSS050) [SSDD487]

The TCS Mission Planner CSCI shall include all necessary information required to be interoperable with the service specific mission planning systems including the Tactical Automated Mission Planning System (TAMPS), Aviation Mission Planning System (AMPS), and Air Force Mission Support System (AFMSS). (SSS051) [SSDD488]

The TCS Mission Planner CSCI shall facilitate automated processing of mission plan data received via C4I interfaces in order to extract the appropriate mission planning data. (SSS052) [SSDD489]

The TCS Mission Planner CSCI shall have the functionality to receive and process AV mission plans from other TCSs. (SSS054) [SSDD490]

The TCS Mission Planner CSCI shall have the functionality to transmit AV mission plans over the TCS Low Speed LAN to other TCSs. (SSS056) [SSDD491]

The TCS Mission Planner CSCI shall include a Flight Route Plan for a selected AV, a Payload Plan for the selected payload, and a Communications Plan. (SSS057) [SSDD492]

The TCS Mission Planner CSCI shall be capable of managing the storage of a minimum of 500 mission plans under unique names to allow for later retrieval. (SSS058) [SSDD493]

The TCS Mission Planner CSCI shall provide the processing to support a graphical user interface via the Workstation Console, that allows the operator the ability to define waypoints on a map based display using a pointing device with full keyset redundancy. (SSS059) [SSDD494]

The TCS Mission Planner CSCI shall have the capability to import as well as create and modify map display overlays for fire support coordination measures (SSS547) [SSDD495], airspace control measures (SSS548) [SSDD496], and threat identification measures. (SSS060) [SSDD497]

The TCS Mission Planner CSCI shall include a standard set of parameters to be entered by the operator such as service (i.e. Army, Navy, etc.), mission type (i.e. reconnaissance, rescue search, battle damage assessment, targeting, training, etc.), AV type (Outrider, Predator as a minimum), payload type (POP EO/IR, MOSP EO/IR, SAR, laser designator as a minimum), communication type(s) (C-band LOS, K-band satellite as a minimum), mission ID, and planned launch time.(SSS068) [SSDD498]

The TCS Mission Planner CSCI shall allow the operator to choose what parameters will be displayed in the continuous feedback window. (SSS068) [SSDD499]

The TCS Mission Planner CSCI shall allow the operator to upload a new mission plan before AV flight.(SSS070) [SSDD500]

The TCS Mission Planner CSCI shall allow the operator to create/retrieve/modify/save/delete mission plans. (SSS071)[SSDD501]

The TCS Mission Planner CSCI shall allow the operator to perform a mission validity check at any time during mission planning and automatically prior to releasing the mission plan for upload to the AV. (SSS073) [SSDD502]

The TCS Mission Planner CSCI shall display the results of the validity check to the operator upon completion. (SSS074) [SSDD503]

The TCS Mission Planner CSCI validity check results shall indicate the problem area(s) of the mission plan if errors were found. (SSS074) [SSDD504]

The TCS Mission Planner CSCI shall notify the operator that the plan is valid if no errors were found during the validity check. (SSS074) [SSDD505]

Waypoints developed by the TCS Mission Planner CSCI shall consist of coordinates, time of arrival, commanded altitude, commanded airspeed, and any other applicable information (loiter time, loiter pattern/parameters, and VCR control as a minimum).(SSS079) [SSDD506]

The TCS Mission Planner CSCI shall allow the operator to perform flight route planning (SSS079) [SSDD507], payload planning (SSS103) [SSDD508], and communication planning (SSS105) [SSDD509] as an integrated process with a single plan entity or as separate processes whose products are to be combined prior to upload to the AV.

The TCS Mission Planner CSCI shall provide the capability to include up to 500 waypoints in each flight route plan.(SSS080) [SSDD510]

The TCS Mission Planner CSCI shall allow the operator to display overlay data consisting of the TCS location (SSS099) [SSDD511], other TCS(s) location(s) (SSS099) [SSDD512], GDT location (SSS099) [SSDD513], RVT(s) location(s) (SSS099) [SSDD514], air vehicle location (SSS096) [SSDD515], airborne relay location(SSS096) [SSDD516], payload cent field of view location (SSS097) [SSDD517], payload footprint location (SSS097) [SSDD518], launch/recovery site(s) location(s) (SSS100) [SSDD519], and route plan waypoints(SSS101) [SSDD520] on the map as a minimum, when the coordinates are displayed on the map.

The TCS Mission Planner CSCI shall allow the operator to choose the coordinate system used for displays, data entry, and computations (UTM 84, MGRS 84, MGRS TD, MGRS NAD27, North American, WGS 72 and WGS 84 as a minimum). Note: WGS 84 is the name of a system, a datum, and an ellipsoid.(SSS102) [SSDD521]

The TCS Mission Planner CSCI shall provide the operator with the necessary tools for mission planning. (SSS397) [SSDD522]

The TCS Mission Planner CSCI shall provide automatically recording of all Mission Plan state data, interface communications and other information necessary to support event reconstruction. (SSS528) [SSDD523]

The TCS Mission Planner CSCI shall provide the capability to display waypoint data in alphanumeric format.(SSS552) [SSDD524]

4.1.2.3.1 Route Planner

The following TCS requirements are allocated to the Route Planner element of the TCS Mission Planner CSCI:

- All route planning requirements for the AV except for dynamic inflight modification.
- Interoperable with Service-specific mission planning systems.
- HCI Requirements.

The TCS Mission Planner CSCI shall provide the capability to display overlays each containing 100 simultaneous icons of known threat systems (SSS061) [SSDD525], of known threat engagement envelops with associated radar terrain masking of those threats (SSS062) [SSDD526], of known fire support coordination zones (SSS549) [SSDD527], and of known airspace control zones (SSS550) [SSDD528].

The TCS Mission Planner CSCI shall have a de-clutter function (SSS063) [SSDD529] that allows the operator to designate only the threats of highest priority for display (SSS064) [SSDD530

The TCS Mission Planner CSCI shall use the signature vs. threats database generated by the AV manufacturer for each AV type to display an AV signature overlay (SSS065) [SSDD531] for each threat. (SSS066) [SSDD532]

The TCS Mission Planner CSCI shall store and retrieve AV performance/characteristic profiles for each type of AV. (SSS069) [SSDD533]

Prior to validating a mission plan, the TCS Mission Planner CSCI shall perform a terrain clearance check for the entire flight route corridor (not just at waypoints) to ensure that the AV will maintain adequate altitude margin (to avoid surface impact) during the entire flight. (SSS0730 [SSDD534]

Prior to validating a mission plan, the TCS Mission Planner CSCI shall perform a fuel consumption analysis for the entire flight route corridor (not just at waypoints) (SSS073) [SSDD535] to ensure that the AV will have sufficient fuel to complete its mission and recovery (SSS076) [SSDD536]..

Prior to validating a mission plan, the TCS Mission Planner CSCI shall perform a threat exposure analysis for the entire flight route corridor (not just at waypoints) to ensure that the AV will not be exposed to threats during any part of the mission.(SSS073) [SSDD537]

Prior to validating a mission plan, the TCS Mission Planner CSCI shall perform an air traffic restriction analysis for the entire flight route corridor (not just at waypoints) to ensure that the AV does not fly into flight restricted areas.(SSS073) [SSDD538]

Prior to validating a mission plan, the TCS Mission Planner CSCI shall perform an AV performance envelope check, using a 6-DOF model and available weather data, for the entire flight route corridor (not just waypoints) (SSS073) [SSDD539] to ensure that the AV can achieve all flight objectives (SSS090) [SSDD540](i.e. maximum rate of climb must be considered when an altitude change is desired;

maximum airspeed must be considered when a specific time over target is desired; high winds may cause the AV to deviate from a desired loiter patter; the AV may be unable to reach a desired destination on time due to head winds).

The minimum set of parameters available for display by the TCS Mission Planner CSCI in the continuous feedback window shall include fuel calculation results (total fuel used and remaining fuel at each waypoint), time calculation results (total time elapsed and time of day at each waypoint), distance calculation results (total route distance and distance between waypoints), areas below the minimum altitude margin, airspace violations, and exposure to threats. (SSS)[SSDD5541]

The TCS Mission Planner CSCI shall optimize a flight route plan, according to the optimization parameters chosen and prioritized by the operator, as the operator creates it (e.g. minimal fuel consumption, minimal threat exposure, etc.) (SSS076) [SSDD542]

The TCS Mission Planner CSCI shall display mission waypoints graphically.(SSS081) [SSDD543]

The TCS Mission Planner CSCI shall display both projected and actual flight path, graphically. (SSS081) [SSDD544]

The TCS Mission Planner CSCI shall provide the capability to enter waypoint data in alphanumeric format. (SSS082) [SSDD545]

The TCS Mission Planner CSCI shall prevent the operator from creating a flight route plan that includes weight and balance conditions that would not be viable due to takeoff constraints. (SSS083) [SSDD546]

AV performance/characteristic profiles utilized by the TCS Mission Planner CSCI shall include AV weight (SSS083) [SSDD547], fuel usage characteristics (SSS084) [SSDD548], fuel weight per unit (SSS084) [SSDD549] , fuel tank capacity (SSS084) [SSDD550] , valid payload types (SSS013) [SSDD551], maximum altitude, stall airspeed, maximum airspeed, maximum climb rate, maximum descent rate, and other data needed by the 6-DOF model.[][]

For mission planning, the TCS Mission Planner CSCI shall provide terrain avoidance warning (SSS085) [SSDD552] and minimum reception altitude calculations for line of sight flights (SSS350) [SSDD553].

The flight route plan developed by the TCS Mission Planner CSCI shall consist of a set of waypoints (SSS087) [SSDD553] and a flight path corridor (SSS093) [SSDD554] (the corridor is a region defined about the flight route which allows for deviations in the actual flight path due to GPS errors, wind, etc.)

The TCS Mission Planner CSCI shall generate a flight route plan to provide the necessary AV commands to autonomously execute a programmed flight and return to a designated recovery area. (SSS091) [SSDD555]

The TCS Mission Planner CSCI shall compute the estimated position of the AV during Loss of Link (LOL) based upon the last known AV position projected along the flight planned route. (SSS146)

[SSDD556]

The TCS Mission Planner CSCI shall provide the capability to display operator definable “Lock Out” zones around waypoints, Launch and Recovery Points (LRPs), or any selected point on the AV flight path. (SSS482) [SSDD557]

4.1.2.3.2 Payload Planner

The following TCS requirements are allocated to the Payload Planner element of the Mission Planner CSCI:

- All payload planning requirements for an EO/IR payload except for dynamic inflight modification.
- Interoperable with Service-specific mission planning systems.
- HCI Requirements.

Prior to validating a mission plan, the TCS Mission Planner CSCI shall perform a payload restriction analysis for the entire flight route corridor (not just at waypoints) to ensure that the payload does not point/activate in payload restricted areas.(SSS073) [SSDD558]

The TCS Mission Planner CSCI shall analyze the payload plan to ensure that payload limitations will not prevent the payload from achieving all mission objectives (cannot view targets effectively at a certain altitude, cannot view targets effectively from a certain horizontal distance/angle, cannot view target area from behind a mountain, cannot view target effectively due to solar or lunar shadowing, cannot view target effectively due to environmental conditions, cannot obtain best thermal imagery due to light/heat transition periods as a minimum).(SSS086) [SSDD559]

The TCS Mission Planner CSCI shall generate a payload plan to provide the necessary payload commands to autonomously execute a programmed payload plan. (SSS091)[SSDD560]

Upon operator command, the TCS Mission Planner CSCI shall display (or remove from display) the search footprint and present center field of view of the payload to indicate the predicted payload FOV swath covered during the mission.(SSS097) [SSDD561]

Upon operator command, the TCS Mission Planner CSCI shall display (or remove from display) target icons indicating the location and types of targets.(SSS098) [SSDD562]

The TCS Mission Planner CSCI shall maintain the payload performance/characteristic profiles which include commands/modes for each payload type (on/off command, pointing commands, zoom/field-of-view commands, tracking commands, focus commands, stow/deploy commands, day/night modes as a minimum).(SSS104) [SSDD563]

When the footprint coordinates are displayed on the map, the TCS Mission Planner CSCI shall display the search footprint of the payload on the map. (SSS157) [SSDD564]

The TCS Mission Planner CSCI shall display the SAR imaging swath on the map display. (SSS479)

[SSDD565]

The TCS Mission Planner CSCI shall provide the on-screen capability to select and efficiently move or reorient a previously defined SAR imaging swath. (SSS480) [SSDD566]

The TCS Mission Planner CSCI shall provide the capability to display the payload swath for planning purposes.(SSS541) [SSDD567]

4.1.2.3.3 Datalink Planner

The following TCS requirements are allocated to the Datalink Planner element of the TCS Mission Planner CSCI:

- All datalink planning requirements except for dynamic inflight modification.
- Interoperable with Service-specific mission planning systems.
- HCI Requirements.

Prior to validating a mission plan, the TCS Mission Planner CSCI shall perform a datalink coverage check for the entire flight route corridor to ensure that the AV will not lose link during any part of the mission. (SSS073) [SSDD568]

The TCS Mission Planner CSCI shall allow the operator to set the LOL delay timer(s) during mission planning. (SSS075) [SSDD569] The LOL delay is the time from when the AV detects an unplanned LOL to the time it initiates LOL procedures.

Prior to validating a mission plan, the TCS Mission Planner CSCI shall determine that the flight constraints of the AV and the limitations of the datalink are not violated.(SSS089) [SSDD570]

The TCS Mission Planner CSCI shall provide altitude calculations for minimum reception for line of sight flights. (SSS350) [SSDD571]

The TCS Mission Planner CSCI shall display a LOL timer to the operator initiating an LOL onset. (SSS536) [SSDD572]

The TCS Mission Planner CSCI shall compute and graphically display Line of Sight versus terrain profile (DTED). (SSS538) [SSDD573]

The TCS Mission Planner CSCI shall include the ability to perform minimum data link reception altitude calculations for line of sight flights.(SSS554) [SSDD574]

4.1.2.3.4 Communications Planner

The following TCS requirements are allocated to the Communications Planner element of the TCS Mission Planner CSCI:

- All communication planning requirements except for dynamic inflight modification.
- Automatic monitoring of communication links while performing prescribed plan.
- Interoperable with Service-specific mission planning systems.
- HCI Requirements.

The TCS Mission Planner CSCI shall have the capability to generate a Communications Plan as part of the Mission Plan. (SSS105) [SSDD575]

The TCS Mission Planner CSCI shall be able to receive a communications plan as part of a Mission Plan from a service specific mission planning system. (SSS106) [SSDD576]

The TCS Mission Planner CSCI shall be able to receive a communications plan as part of a Mission Plan from another TCS. (SSS106) [SSDD577]]

The TCS Mission Planner CSCI's Communications Plan shall include the information which defines the C4I connectivity, as well as the RF Coordination Plan. (SSS107) [SSDD578]

4.1.2.3.5 Plan Monitoring

The following TCS requirements are allocated to the Plan Monitoring element of the TCS Mission Planner CSCI:

- Automatic monitoring of AV while flying mission plan, to include AV's capability to complete mission plan.
- Automatic monitoring of payload while performing prescribed plan.
- Automatic monitoring of datalink while performing prescribed plan.
- Automatic monitoring of communication links while performing prescribed plan.
- HCI Requirements.

The TCS Mission Planner CSCI shall provide the capability to monitor AV adherence to the uplinked mission plan, detecting any deviations greater than 10%, and notifying the operator via the Work Station Console when deviations are detected. (SSS141) [SSDD579]

The TCS Mission Planner CSCI shall provide the capability to monitor payload adherence to the uplinked mission plan. (SSS155) [SSDD580]

When the TCS Mission Planner CSCI determines the payload is not adhering to the uplinked mission plan (SSS141) [SSDD581] the operator shall be notified within TBD milliseconds (SSS155) [SSDD582]

4.1.2.4 SAR CSCI

The SAR CSCI will consist of the following basic elements:

1. SAR Payload Control

2. SAR Imagery Viewer
3. SAR Imagery Data Acquisition
4. NITF Files

4.1.2.4.1 SAR Payload Control

The SAR CSCI shall be interoperable with SAR Payloads. (SSS013) [SSDD583]

The SAR CSCI shall have the capability to control and monitor the SAR payload. (SSS147) [SSDD584]

4.1.2.4.2 SAR Imagery Viewer

The SAR CSCI shall have the functionality to process payload product data from Synthetic Aperture Radar (SAR) payloads. [SSS182] [SSDD585]

The SAR CSCI shall be able to store up to 24 hours of SAR payload imagery and associated telemetry data. [SSS184] [SSDD586]

4.1.2.4.3 SAR Imagery Data Acquisition

The SAR CSCI shall have the functionality to process payload product data to include correlating, formatting, storing, and internally routing payload information. (SSS182) [SSDD587]

4.1.2.4.4 NITF Files

The SAR CSCI shall be in compliance with Common Imagery Ground Surface Station (CIGSS), United States Imagery Standards (USIS), National Imagery Transmission Format (NITF) Version 2.0 and Global Command Control Systems (GCCS) when processing payload imagery data. (SSS185) [SSDD588]

The NITF 2.0 imagery files generated by SAR CSCI shall contain the necessary telemetry and support data to permit subsequent imagery exploitation by C4I systems. (SSS186) [SSDD589]

4.1.2.5 C4I Interfaces CSCI

The following TCS requirements are allocated to this Configuration Item:

- All C4I software requirements.
- HCI Requirements.

The C4I Interfaces CSCI shall have the functionality to receive AV mission plans from service specific mission planning systems. (SSS053) [590]

The C4I Interfaces CSCI shall notify TCS Mission Planner when a AV mission plan was received

from service specific mission planning systems and the corresponding file name. (SSS053) [SSDD591]

The C4I Interfaces CSCI shall have the functionality to transmit AV mission plans to service specific mission planning systems. (SSS055) [SSDD592]

The C4I Interfaces CSCI shall be capable of entering DII/COE compliant (C4I) networks. Network interoperability will include, but not be limited to:

1. Radio data burst connectivity to Automatic Target Hand-off Systems (ATHS)
2. Advanced Field Artillery Tactical Data Systems (AFATDS)
3. Army Deep Operations Coordination System (ADOCS)
4. Wire connectivity to the All Source Analysis System (ASAS)
5. The Intelligence Analysis System (IAS)
6. The Joint Standoff Target Attack Radar System (JSTARS) Ground Station Module/Common Ground Station (GSM/CGS)
7. The Joint Maritime command Information System (JMCIS)
8. Closed Circuit Television (CCTV)
9. Advanced Tomahawk Weapons Control Station (ATWCS)
10. Joint Deployable Intelligence Support System (JDISS)
11. Trojan Special Purpose Integrated Remote Intelligence Terminal (SPIRIT) II
12. Joint Service Imagery Processing System (JSIPS)
13. JSIPS Tactical Exploitation Group (JSIPS TEG)
14. Tactical Exploitation System (TES)
15. Service Mission Planners
16. The Theater Battle Management Core System (TBMCS)
17. The Guardrail Common Sensor Aerial Common Sensor (ACS) Integrated Processing Facility (IPF)
18. Modernized Imagery Exploitation System (MIES)
19. Enhanced Tactical Radar Correlator (ETRAC)
20. Contingency Airborne Reconnaissance System (CARS)
21. Common Operational Modeling, Planning, and Simulation System (COMPASS) [SSS209] [SSDD593]

The C4I Interfaces CSCI shall have the functionality necessary to manage all aspects of C4I system interfaces to include receiving, processing, and transmitting tactical information to include but not limited to character based text messages, NITF 2.0 imagery files, and RS-170A video. (SSS210) [SSDD594]

The C4I Interfaces CSCI shall provide the functionality necessary to interface with various C4I systems in order to satisfy the operational requirements for:

1. Tasking TCS to plan and conduct a mission. (SSS211)] [SSDD595]
2. Presentation of payload product and target coordinates for export and dissemination (SSS211)] [SSDD596].
3. Use of UAV obtained data (Non-real time tracks, tactical points and amplifying information) to provide a C4I system with information that may be used by C4I system operators, for transmission on tactical data communication links, and available to support engagement by appropriate weapons systems. (SSS211)] [SSDD597]

The C4I Interfaces CSCI shall have the capability to interoperate with a server to receive, extract, and push intelligence data. (SSS212) [SSDD598]

The C4I Interfaces CSCI shall have the capability to use cable to deliver live video imagery in multiple locations. (SSS213) [SSDD599]

The C4I Interfaces CSCI shall have the ability to interface with service specific ground and airborne Ultra High Frequency (UHF), Very High Frequency (VHF), UHF/VHF, and High Frequency (HF) radios for digital message transmission while using the same radios for record traffic. (SSS214) [SSDD600]

Where applicable, the C4I Interfaces CSCI data burst messages shall comply with Variable Message Formats. (SSS215) [SSDD601]

The C4I Interfaces CSCI shall export and disseminate digital imagery. (SSS218) [SSDD602]

The C4I Interfaces CSCI shall export and disseminate RS-170A video (with or without overlay). (SSS219) [SSDD603]

The C4I Interfaces CSCI shall export and disseminate tactical communication messages. (SSS220) [SSDD604]

The C4I Interfaces CSCI shall have the functionality to provide the following control capabilities:

1. Send and receive tactical communication messages (SSS222) [SSDD605]

2. Send and receive annotated and un-annotated digital imagery (SSS223) [SSDD606]

3. Establish (and when completed terminate) digital communication with C4I systems. (SSS224) [SSDD607]

4. Establish (and when completed terminate) digital communication to peripheral devices. (SSS225) [SSDD608]

5. Send and receive analog imagery in RS-170A format with or without overlay. (SSS226) [SSDD609]

6. Establish (and when completed terminate) analog communication to C4I systems. (SSS227) [SSDD610]

7. Establish (and when completed terminate) analog communication to peripheral devices. (SSS228) [SSDD611]

The C4I Interfaces CSCI shall have the functionality to provide the following digital data processing capability:

1. Create Tactical Communications Messages to include United States Message Text Format (USMTF), Tactical Fire (TACFIRE), Over The Horizon Gold (OTH-Gold), and Intelligence and Electronic Warfare Character Oriented Message Catalog (IEWCOMCAT) For Transmission (specific message types will be identified in the TCS to C4I IDD) (SSS230) [SSDD612]
2. Review for completeness incoming Tactical Communication Messages [SSS231] [SSDD613]
3. Transmit annotated as well as unannotated digital imagery (SSS232) [SSDD614]
4. Review for completeness incoming annotated as well as un-annotated digital imagery (SSS233) [SSDD615]

All digital messages received by the C4I Interfaces CSCI shall be automatically checked for errors and corrected when possible. (SSS234) [SSDD616]

All erroneous messages that cannot be corrected by the C4I Interfaces CSCI shall be flagged to the TCS Core Functionality CSCI. (SSS235) [SSDD617]

The C4I Interfaces CSCI shall provide the capability to log all incoming and outgoing formatted tactical messages. (SSS236) [SSDD618]

The C4I Interfaces CSCI shall have the functionality to monitor the status of all C4I interfaces and pass this information on to the TCS Core Functionality CSCI. (SSS239) [SSDD619]

The C4I Interfaces CSCI shall have the functionality to provide the following data monitoring capability:

1. Monitor the status of all incoming and outgoing tactical communication messages (SSS241) [SSDD620]

The C4I Interfaces CSCI shall provide the capability to interface with equipment necessary to provide connectivity with standard DoD tactical (VHF, UHF, and UHF/VHF) radios, Mobile Subscriber Equipment, and military and commercial satellite communications equipment. (SSS285) [SSDD621]

The C4I Interfaces CSCI shall interface with external mission tasking systems (e.g., receive tasking orders, coordinate mission certification). (SSS286) [SSDD622]

For external communications to C4I systems, the C4I Interfaces CSCI shall utilize Tactical Communications (TACCOM) which will consist of a set of software modules accessed through an Application Programming Interface (API). (SSS290)[SSDD623]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with ASAS Version TBD. (SSS291) [SSDD624]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for

communication with JSTARS GSM Version TBD. (SSS292) [SSDD625]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with JMCIS Version TBD. (SSS293) [SSDD626]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with JSIPS Version TBD. (SSS294) [SSDD627]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with AFATDS Version TBD. (SSS295) [SSDD628]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with ADOCS Version TBD. (SSS296) [SSDD629]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with CARS Version TBD. (SSS297) [SSDD630]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with CCTV Version TBD. (SSS298) [SSDD631]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with Service Mission Planners Version TBD. (SSS299) [SSDD632]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with GCS/ACS Version TBD. (SSS300) [SSDD633]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with JDISS Version TBD. (SSS301) [SSDD634]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with TES Version TBD. (SSS302) [SSDD635]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow the TCS to communicate with IAS Version TBD. (SSS303) [SSDD636]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with ATHS Version TBD. (SSS304) [SSDD637]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with ATWCS Version TBD. (SSS305) [SSDD638]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with Trojan Spirit II Version TBD. (SSS306) [SSDD639]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with TBMCS Version TBD. (SSS307) [SSDD640]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for

communication with MIES Version TBD. (SSS308) [SSDD641]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with ETRAC Version TBD. (SSS309) [SSDD642]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with COMPASS Version TBD. (SSS310) [SSDD643]

The C4I Interfaces CSCI shall provide the necessary software functionality to allow for communication with JSIPS TEG Version TBD. (SSS311) [SSDD644]

The C4I Interfaces CSCI shall provide the capability to receive and process navigation data transferred from external navigation equipment. (SSS321) [SSDD645]

To achieve interoperability the C4I Interfaces CSCI shall provide a consistent and common set of interfaces for the United States Message Text Format (USMTF), Army Tactical Command Control System (ATCCS), and Field Artillery Tactical Data System (FATDS). (SSS406) [SSDD646]

The C4I Interfaces CSCI shall provide external interfaces for the C4I communications media. (SSS407) [SSDD647]

The C4I Interfaces CSCI shall provide API's for the transmission of imagery in National Imagery Transmission Formats (NITF) 1.0a and 2.0 as per MILSTD-2500 and to be compatible with the Common Imagery Ground/Surface Station (CGIS) Guidelines. (SSS408) [SSDD648]

The C4I Interfaces CSCI shall provide automatic recording of all C4I Interfaces state data, interface communications and other information necessary to support event reconstruction. (SSS528) [SSDD649]

4.1.2.6 DII/COE CSCI

The DII/COE CSCI is a Government assembled Common Operating Environment. The DII/COE CSCI provides information management services of all kinds from Mapping, Charting, Geodesy, and Imagery Services to Message Processing Services to Printer Control Services. The DII Imagery Services provide services ranging from Image Exploitation Services (IESs) to NITF file generation.

The DII/COE CSCI shall provide the graphics and mapping capability required to perform flight route planning.(SSS092) [SSDD650]

The DII/COE CSCI shall provide the capability to display (or remove from display) a map.(SSS095) [SSDD651]

The DII/COE CSCI shall provide the capability to scroll the map display left, right, up, and down as desired.(SSS095) [SSDD652]

The DII/COE CSCI shall provide the capability to scroll the map such that a specified set of coordinates is at the center of the map display.(SSS095) [SSDD653]

The DII/COE CSCI shall provide the capability to commence automatic scrolling of the map (SSS095) [SSDD654] such that the AV position remains displayed on the map. (SSS096) [SSDD655]

The DII/COE CSCI shall provide the capability to cause the display to zoom in and zoom out as desired.(SSS095) [SSDD656]

The DII/COE CSCI shall provide the capability to commence automatic scrolling of the map such that the payload field of view remains displayed on the map.(SSS097) [SSDD657]

The DII/COE CSCI shall provide the capability to import National Imagery Mapping Agency (NIMA) Digital Terrain Elevation Data (DTED), Digital Feature Analysis Data (DFAD), Arc Digitized Raster Graphic and scanned hard copy maps, via compact disk. (SSS280) [SSDD658]

The DII/COE CSCI shall provide the capability to import map information via operator procedure (SSS555) [SSDD659] and shall provide the capability of incorporating vector format and Compressed ADRG (CADRG) maps. (SSS281) [SSDD660]

The DII/COE CSCI shall provide the processing capability to coordinate the printing of freeze-frame video, C4I Messages, Mission Plans, FD/L information, and current map displays. (SSS315) [SSDD661]

The DII/COE CSCI shall provide the processing capability to output digital message data and imagery to a hard copy printer. (SSS316) [SSDD662]

The DII/COE CSCI shall provide the capability to receive and process digital data and digital imagery transferred from external storage systems. (SSS318) [SSDD663]

The DII/COE CSCI shall provide the capability to send and receive data from all the TCS data storage devices. (SSS339) [SSDD664]

The DII/COE CSCI shall provide the capability to transfer digital data or digital imagery to and from external data storage devices. (SSS340) [SSDD665]

The DII/COE CSCI shall provide the operator with a clearly indicated map scale. (SSS535) [SSDD666]

The DII/COE CSCI shall provide the capability to compute the range and bearing between two geographic positions located on the map display.(SSS561) [SSDD667]

4.1.2.7 Real Time Processes (RTP) CSCI

The RTP CSCI will consist of the following basic elements:

1. Antenna Control
2. AVSI Conversion
3. CARS Conversion
4. IBLS Conversion

4.1.2.7.1 Antenna Control

4.1.2.7.2 AVSI Conversion

The RTP CSCI shall provide the capability to monitor specific telemetry elements in real-time, and record all or selected telemetry elements for future review or processing. (SSS140) [SSDD668]]

The RTP CSCI shall provide the system functionality necessary to receive (SSS287) [SSDD669] and interpret mission function data from the DCM HWCIs. (SSS312) [SSDD670]

4.1.2.7.3 CARS Conversion

The RTP CSCI shall provide the functionality necessary to process data from the CARS HWCI. (SSS289) [SSDD671]

4.1.2.7.4 IBLS Conversion

The RTP CSCI shall provide the functionality necessary to process data from the IBLS HWCI. (SSS289) [SSDD671]

4.1.2.8 TCS Data Server CSCI

The TCS Data Server CSCI shall be configured to support information flow both to and from the AV. (SSS325) [SSDD672]

The TCS Data Server CSCI shall have internal interfaces with all other CSCIs (SSS326) [SSDD673] allowing information from the data server to be made available to other components of the TCS. (SSS327) [SSDD674]

The TCS Data Server CSCI shall support a distributed processing capability (SSS328) [SSDD675]; such that, remotely hosted TCS applications shall communicate in a client server relationship. (SSS329) [SSDD676]

The SAR data received by the Data Server CSCI over the High/Low LAN shall be distributed to other TCS CSCIs. (SSS330) [SSDD677]

The TCS Data Server shall provide automatic recording of all TCS Data Server state data, internal interface communications, and other information necessary to support event reconstruction. (SSS528) [SSDD678]

4.1.2.9 User Interface Manager CSCI

4.2 Concept of Execution

The purpose of the TCS is to provide a common command and control station for the family (includes Predator) of tactical UAVs. The TCS shall be designed to be scaleable and tailored to a wide range of users. The TCS will control a UAV on Reconnaissance, Intelligence, Surveillance, and Target Acquisition (RISTA) missions.

Figure 4.2-1 depicts a tactical scenario that illustrates all five possible levels of interaction for TCS operation. A shipboard UAV detachment launches an Outrider from am LHA-Class ship (Level 5) to observe the beachhead. Marines on board the LHA receive the UAV video via a TCS fed closed circuit television (Level 1). Marines and Sailors on other ships have a direct receipt of imagery via remote video terminals (Level 2). A Navy/Marine team receives AV and payload control of the LHA-launched Outrider to support a detachment ashore. The Air Force at a Forward Operating Location (FOL) 100 miles away receives freeze-frame images via C4I (Level 5) for situation awareness. To ensure their needs are met, the Army Corps has a direct, real time influence on the payload (Level 3), as well as a forward observer directly receiving imagery (Level 2). At the end of the mission the Outrider control is passed to the Launch and Recovery detachment (Level 5).

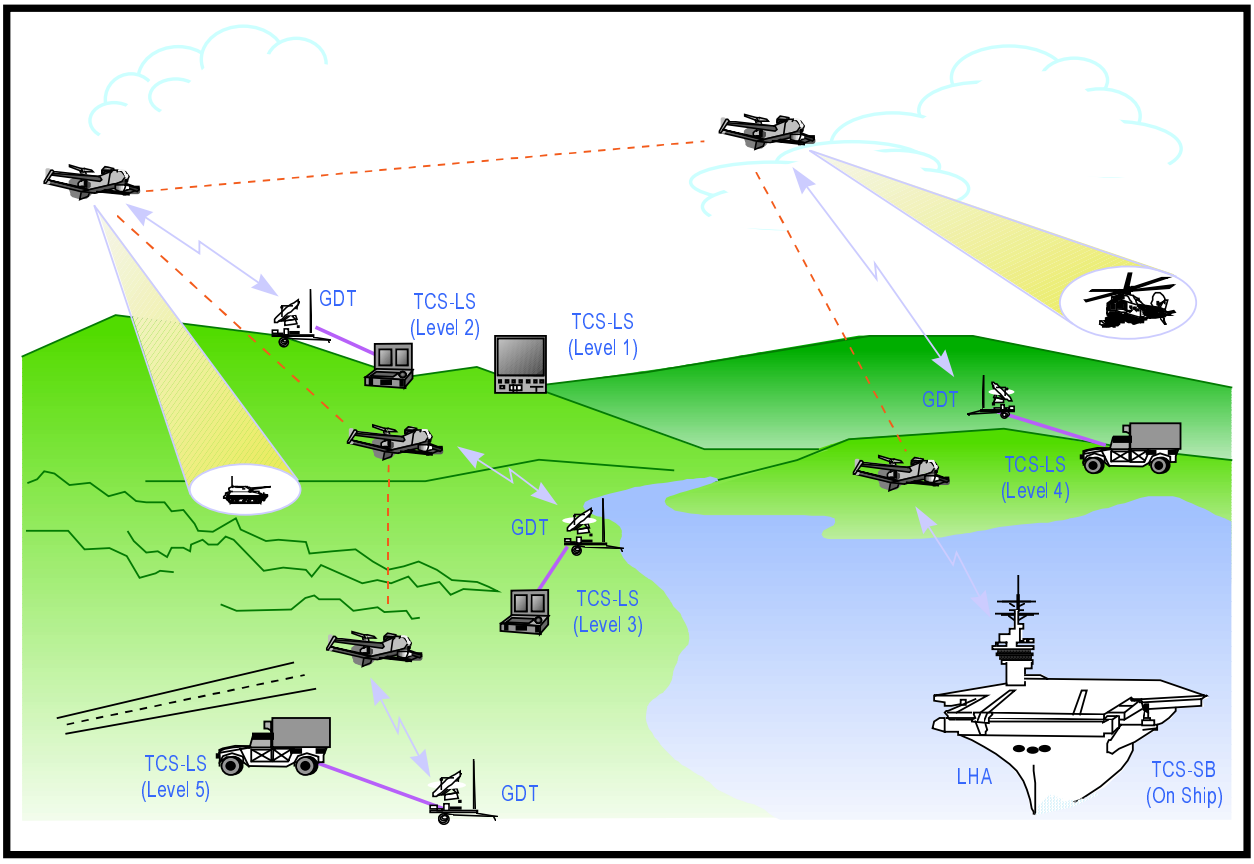

Figure 4.2-1 Tactical Scenario illustrating all five levels of TCS application

TABLE FOR WHAT CSCIs AND HWCIs ARE REQUIRED FOR DIFFERENT LEVELS OF INTERACTION tbd. Also need statement that software is same for all levels of interaction and hardware configurations.

Table 4.2-1 Scaleability Options for TCS.

4.2.1 Flow of Execution Control

The TCS shall execute the states and modes shown in Figures 4.2.1-1, 4.2.1-2, and 4.2.3-3. The states transition diagram is shown in Figure 4.2.1-1. The modes comprising the Start-Up State and Operations State are detailed in Figures 4.2.1-2 and 4.2.1-3, respectively. There are no modes associated with the Shut-down state.

The state of operation of TCS shall be readily apparent to the operator and to other network members. The state of readiness shall be easily communicated to other network members. Connectivity shall be easily identified by TCS communication protocols during system initiation. Should system connectivity be disrupted during normal operations, line loss or link loss shall be readily communicated to the operator.

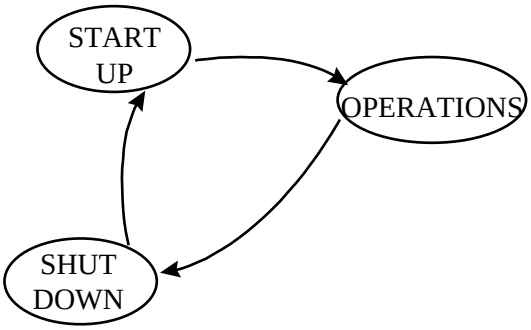

Figure 4.2.1-1 TCS State Diagram

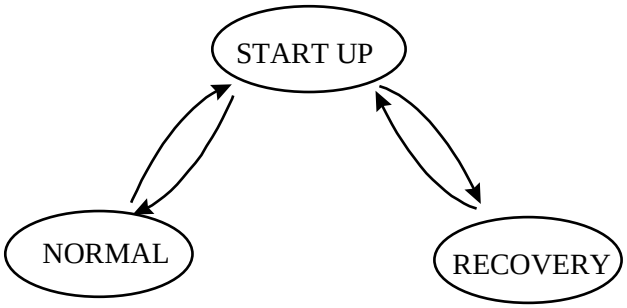

Figure 4.2.1-2 TCS Startup State and Associated Modes Diagram

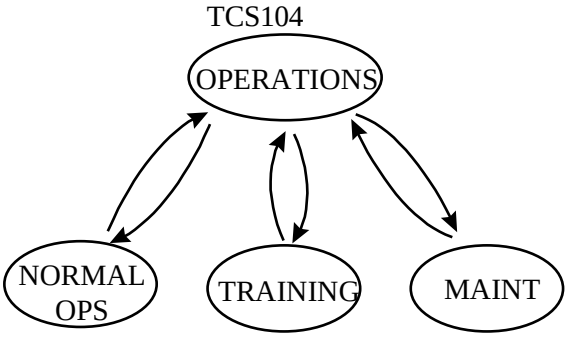

Figure 4.2.1-3 TCS Operations State and Associated Modes Diagram

The TCS data latency shall not be greater than that present in the Predator ground control station or Outrider ground control station, whichever is smaller. (SSS409) [SSDD679]

There shall be no modes of operation in the shutdown state. (SSS048) [SSDD680]

The TCS shall provide the functionality to have a maximum delay time of TBD from operator command to system acknowledgment and response.(SSS559) [SSDD681}

After emplacement at the operational site, TCS shall be capable of planning and launching a mission within 1 hour of tasking. (SSS441) [SSDD682] Required activities include 1) preparing an AV for flight, 2) datalink terminal set-up, 3) safety equipment in place, 4) the TCS computer placed in the Operations State, and 5) support hardware up and running.

TCS shall be capable of operating continuously for a minimum of 72 hours. (SSS442) [SSDD683]

4.2.1.1 Normal Operations Mode Execution

The TCS shall allow operators to sub-divide in any manner these activities of execution between all TCSs connected to the Datalink Network. The following describes each activity for the Normal Operations Mode:

In the Normal Operations Mode, all of the CSCIs shall be capable of executing concurrently. (SSS037) [SSDD684]

The TCS shall support 5 levels of UAV interaction: (SSS010) [SSDD685]

Level 1: receipt and transmission of secondary imagery and/or [as well as] data

Level 2: direct receipt of imagery and/or [as well as] data

Level 3: control of the UAV payload in addition to direct receipt of imagery/data

Level 4: control of the UAV, less launch and recovery, plus all the functions of level three

Level 5: capability to have full function and control of the UAV from takeoff to landing

When in the Operations State the TCS shall be capable of operating in three modes: normal

operations mode, training operations mode, and maintenance operations mode. (SSS032) [SSDD686]

In the Normal Operations Mode the TCS shall support the following functions: (SSS037) [SSDD687]

1. Mission Planning
2. Mission Control and Monitoring
3. Payload Product Management
4. Target Coordinate Development
5. C4I Systems Interface

Functions under the Normal Operations Mode shall operate concurrently without precluding or excluding any of the other functions, in accordance with allowable operations as determined by the appropriate levels of interaction. (SSS038) [SSDD688]

All of the activities described below shall be capable of executing concurrently. Each of these activities is discussed below:

4.2.1.1.1 C4I Communication Reception

This activity involves the C4I Support Equipment HWCI, TCS Computer HWCI, C4I Interfaces CSCI, TCS Core Functionality CSCI, DII/COE-Operating System CSCI, and Work Station Console HWCI for the reception and displaying of C4I messages. This activity is started when either the C4I Support Equipment HWCI receives a message. The C4I Support Equipment HWCI notifies C4I Interfaces CSCI that a message is being received. The C4I Interfaces CSCI working with the C4I Support Equipment HWCI and TCS Computer HWCI coordinate the reception of the message into the TCS Computer's memory. When the message is received or errors occur C4I Interfaces CSCI notifies the operator via TCS Core Functionality CSCI and the Work Station Console HWCI, completing this activity.

The C4I reception data flows from the C4I Support Equipment HWCI to the TCS Computer HWCI to TCS Core Functionality CSCI to the Work Station Console HWCI to display the received C4I message. The TCS C4I Interfaces CSCI also logs the messages.

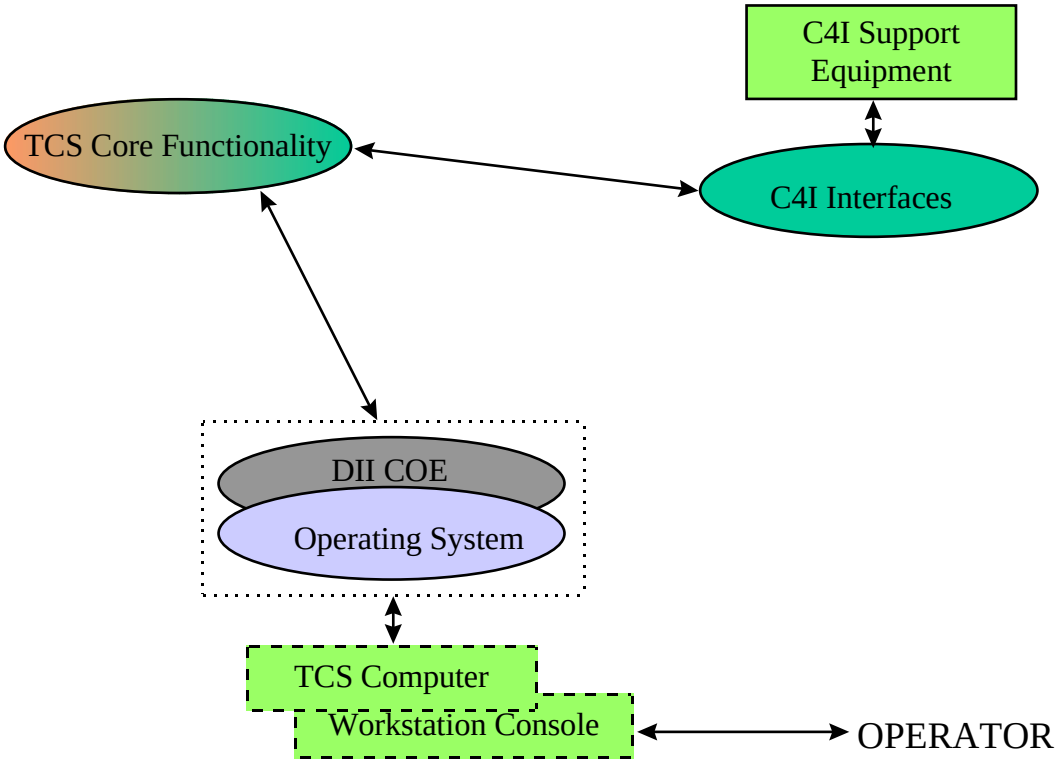

Figure 4.2.1.1.1-1 C4I Communication Reception Data Flow Diagram

4.2.1.1.2 C4I Communication Transmission

This activity involves the Work Station Console HWCI, TCS Computer HWCI, TCS Core Functionality CSCI, C4I Interfaces CSCI, C4I Support Equipment HWCI, for the transmission of C4I messages. This activity normally is started when the operator initiates a send C4I message command. The C4I Interfaces CSCI working with the TCS Computer HWCI, C4I Support Equipment HWCI, and MSE/SINCGARS coordinate the transmission of the message. When errors occur in the transmission process C4I Interfaces CSCI will notify the operator via TCS Core Functionality CSCI and the Work Station Console HWCI. This activity is completed after the successful message transmission or the notification of error has been provided to the operator. The TCS C4I Interfaces CSCI also logs the messages transmission.

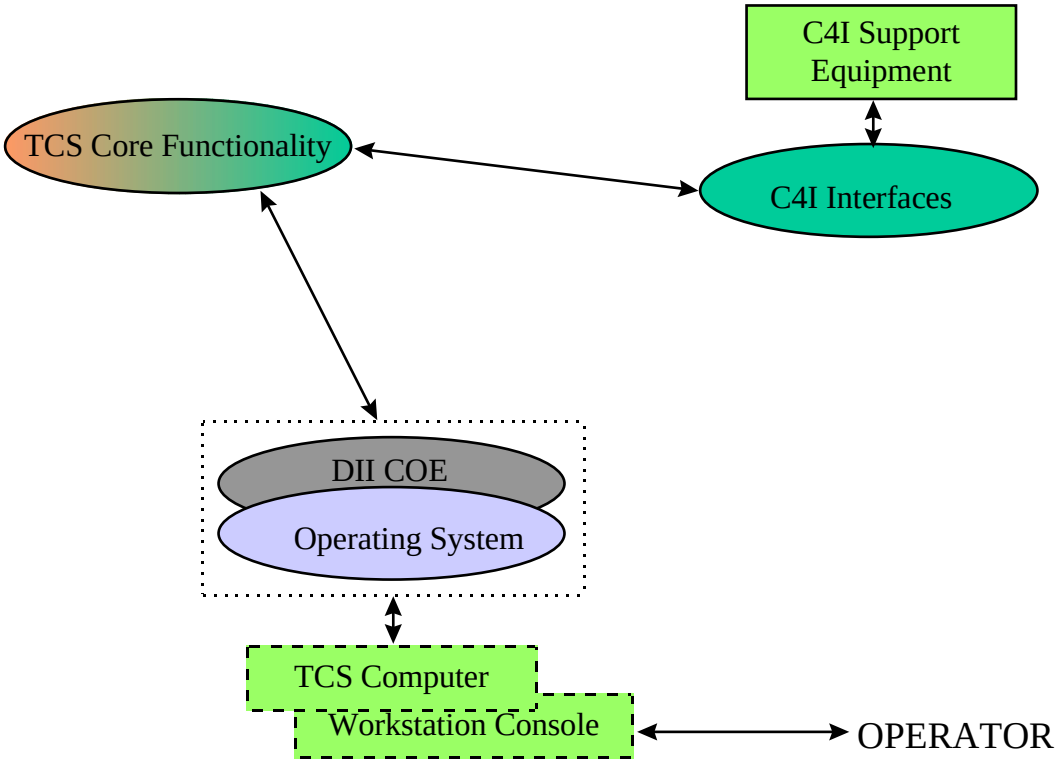

Figure 4.2.1.1.2-1 C4I Communication Transmission Data Flow Diagram

4.2.1.1.3 Transfer Control of AV

This activity involves the Work Station Console HWCI, TCS Core Functionality CSCI, C4I Interfaces CSCI, TCS Computer HWCI, C4I Support Equipment HWCI, and a remote TCS; for the transfer of AV control through the Datalink Network. This activity is started when the operator indicates transfer of control of the AV to another TCS. When control is being transferred to a remote TCS the TCS Core Functionality CSCI will coordinate the transfer through the Datalink Network. When errors occurs in the transfer process the TCS Core Functionality CSCI will notify the operator. This activity is completed after the successful transfer of control or an error message has been provided to the operator.

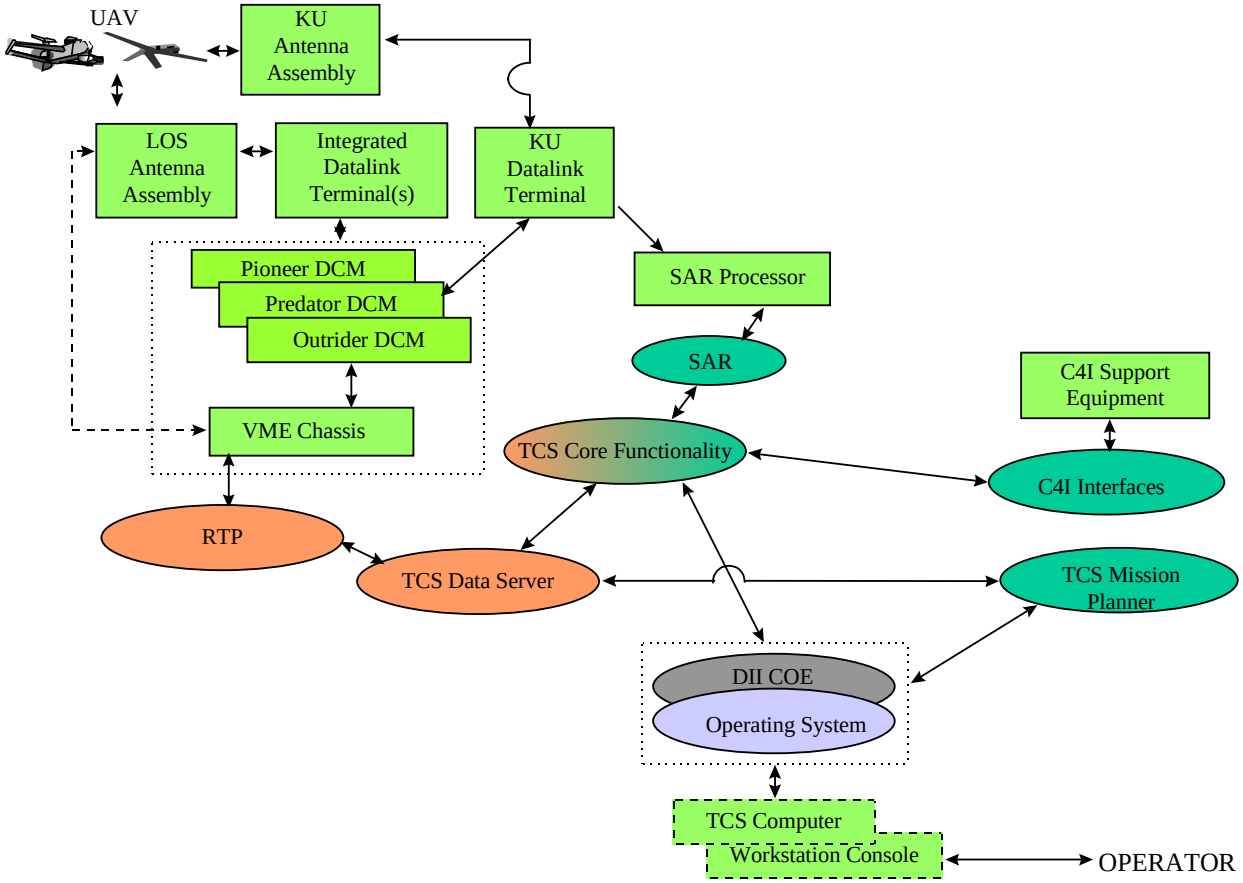

Figure 4.2.1.1.3-1 Transfer Control of an AV Data Flow Diagram

4.2.1.1.4 Receive Control of AV

This activity involves the Work Station Console HWCI, TCS Core Functionality CSCI, C4I Interfaces CSCI, TCS Computer HWCI, C4I Support Equipment HWCI, and a remote TCS; for the receipt of AV control through the Datalink Network. This activity is started when the operator indicates receipt of control of the AV from another TCS. When control is being received by a remote TCS the TCS Core Functionality CSCI will coordinate the transfer through the Datalink Network. When errors occurs in the receive process the TCS Core Functionality CSCI will notify the operator. This activity is completed after the successful receipt of control or an error message has been provided to the operator.

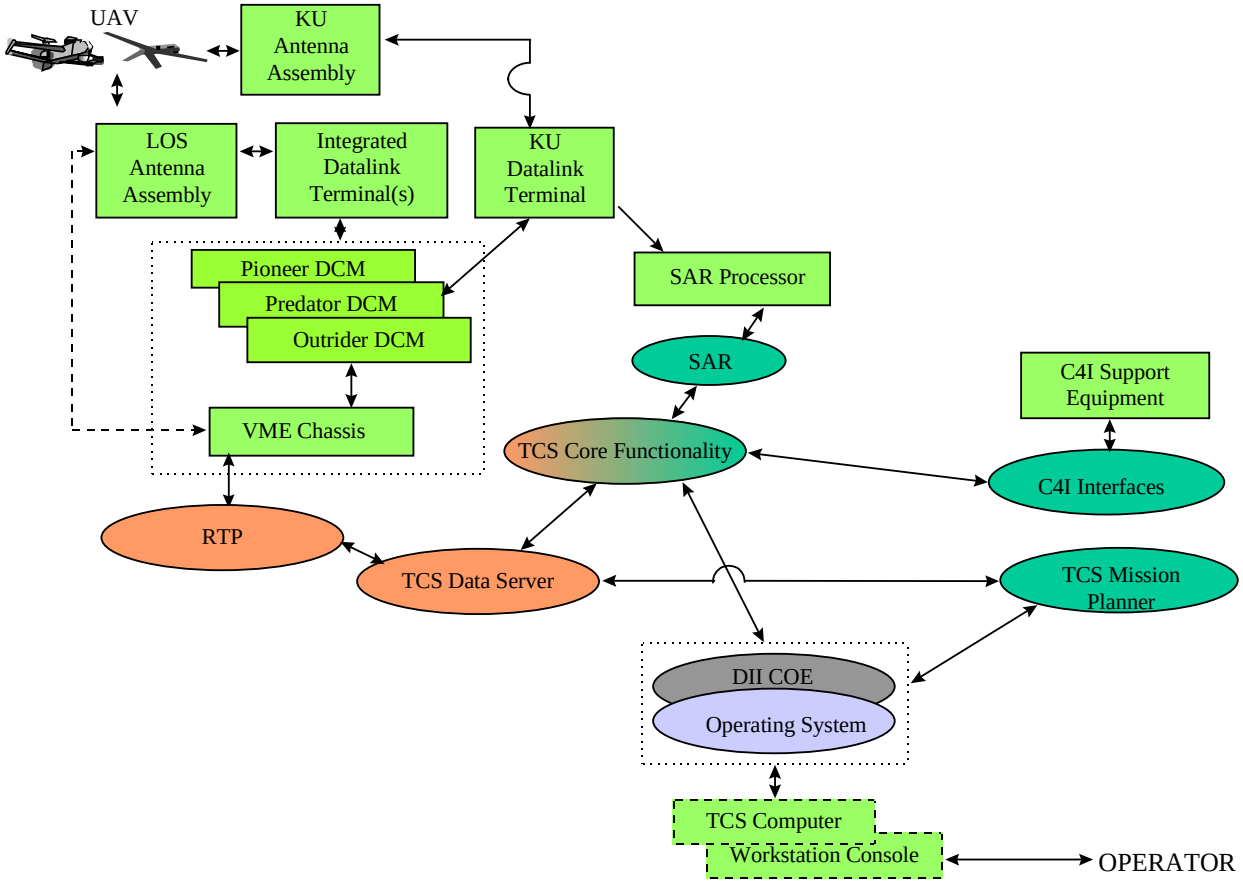

Figure 4.2.3-1 Receipt of AV Control Data Flow Diagram

4.2.1.1.5 Transfer Control of Payload

This activity involves the Work Station Console HWCI, TCS Core Functionality CSCI, C4I Interfaces CSCI, TCS Computer HWCI, C4I Support Equipment HWCI, and a remote TCS for the transfer of Payload control through the Datalink Network. This activity is started when the operator indicates transfer of control of the Payload to another TCS. The Core Functionality CSCI will coordinate the transfer through the Datalink Network. When errors occur in the transfer process the Core Functionality CSCI will notify the operator. This activity is completed after the successful transfer of control or an error message has been provided to the operator.

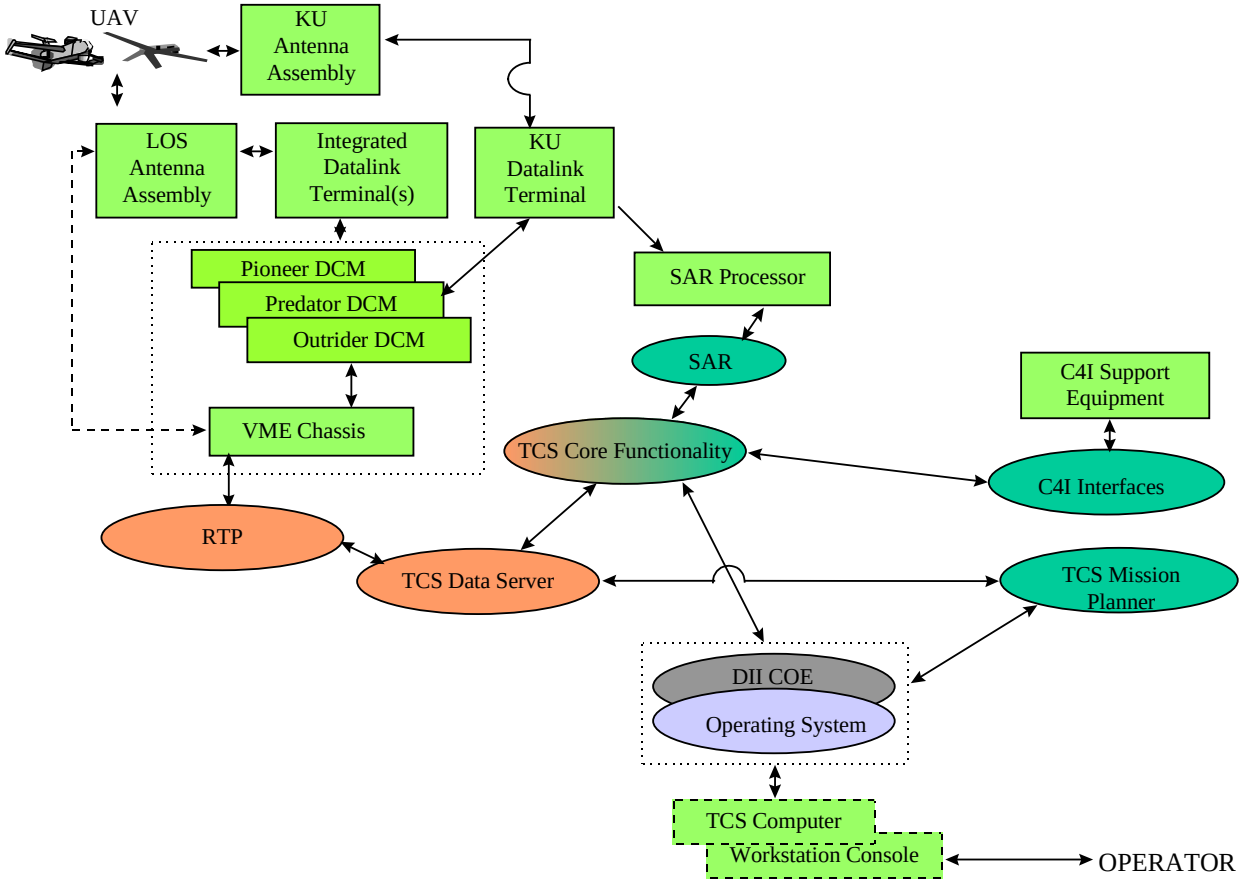

Figure 4.2.1.1.5-1 Transfer of Payload Control Data Flow Diagram

4.2.1.1.6 Receive Control of Payload

This activity involves the Work Station Console HWCI, TCS Core Functionality CSCI, C4I Interfaces CSCI, TCS Computer HWCI, C4I Support Equipment HWCI, and a remote TCS for the receipt of Payload control through the Datalink Network. This activity is started when the operator indicates receipt of control of the Payload from another TCS. The Core Functionality CSCI will coordinate the receipt through the Datalink Network. When errors occur in the receive process the Core Functionality CSCI will notify the operator. This activity is completed after the successful receipt of control or an error message has been provided to the operator.

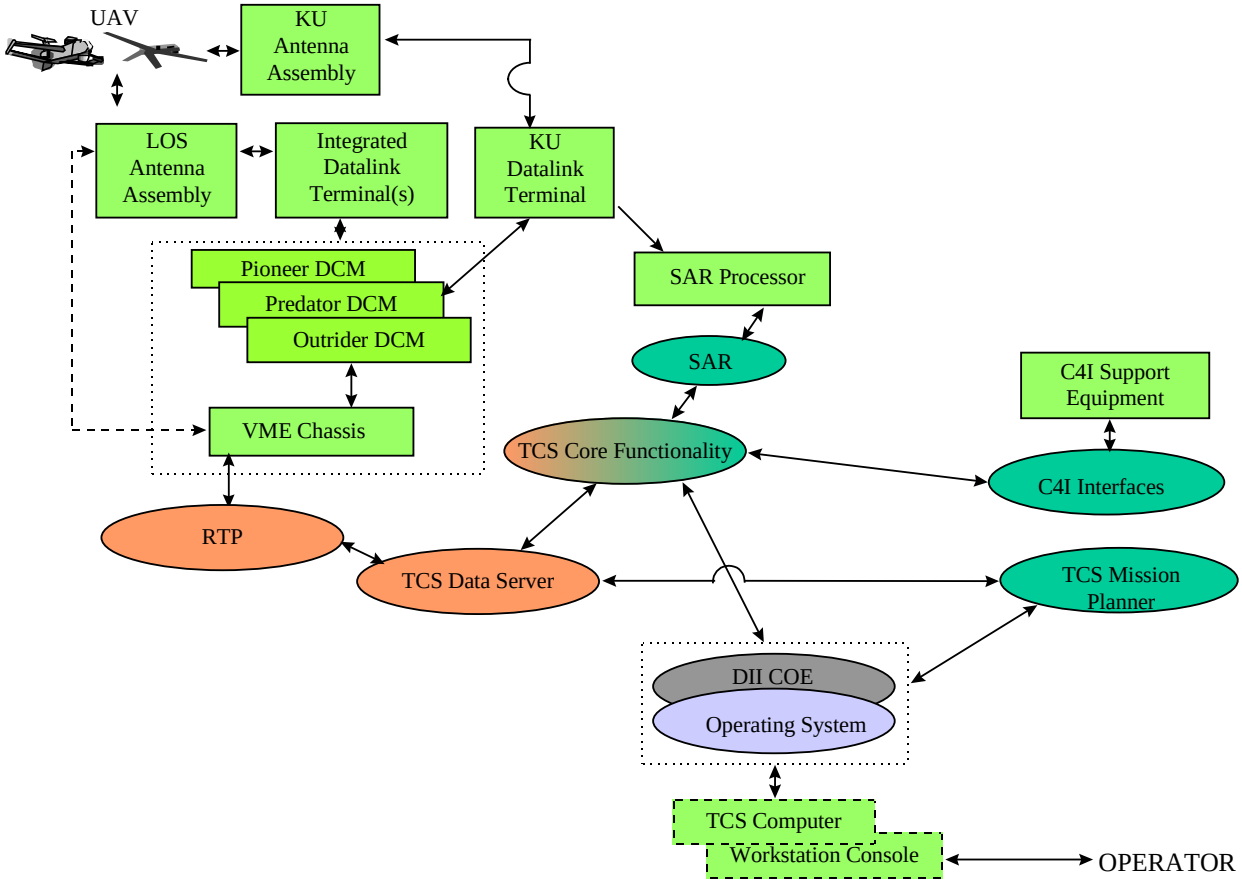

Figure 4.2.1.1.6-1 Receipt of Payload Control Data Flow Diagram

4.2.1.1.7 AV Launch

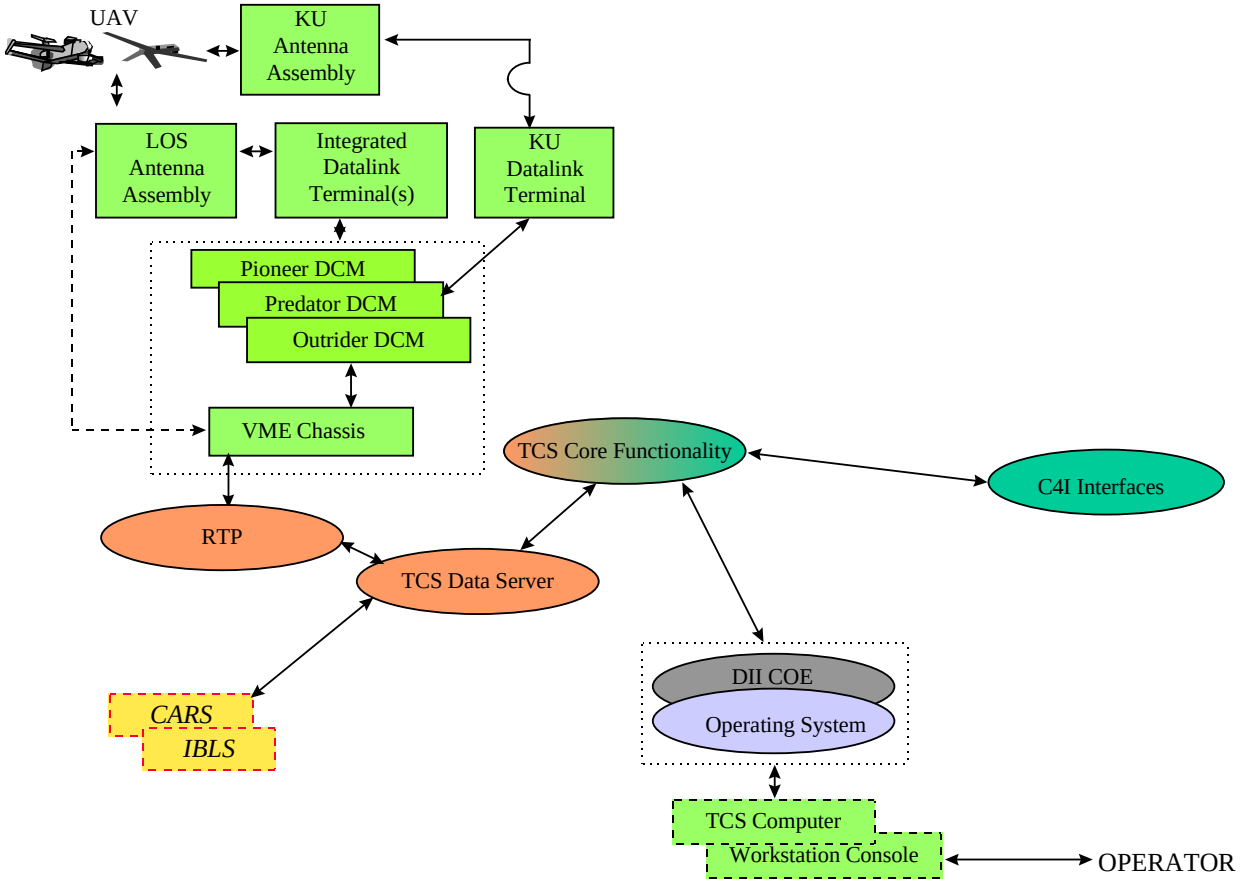

Figure 4.2.1.1.7-1 AV Launch Data Flow Diagram

4.2.1.1.8 AV Recovery

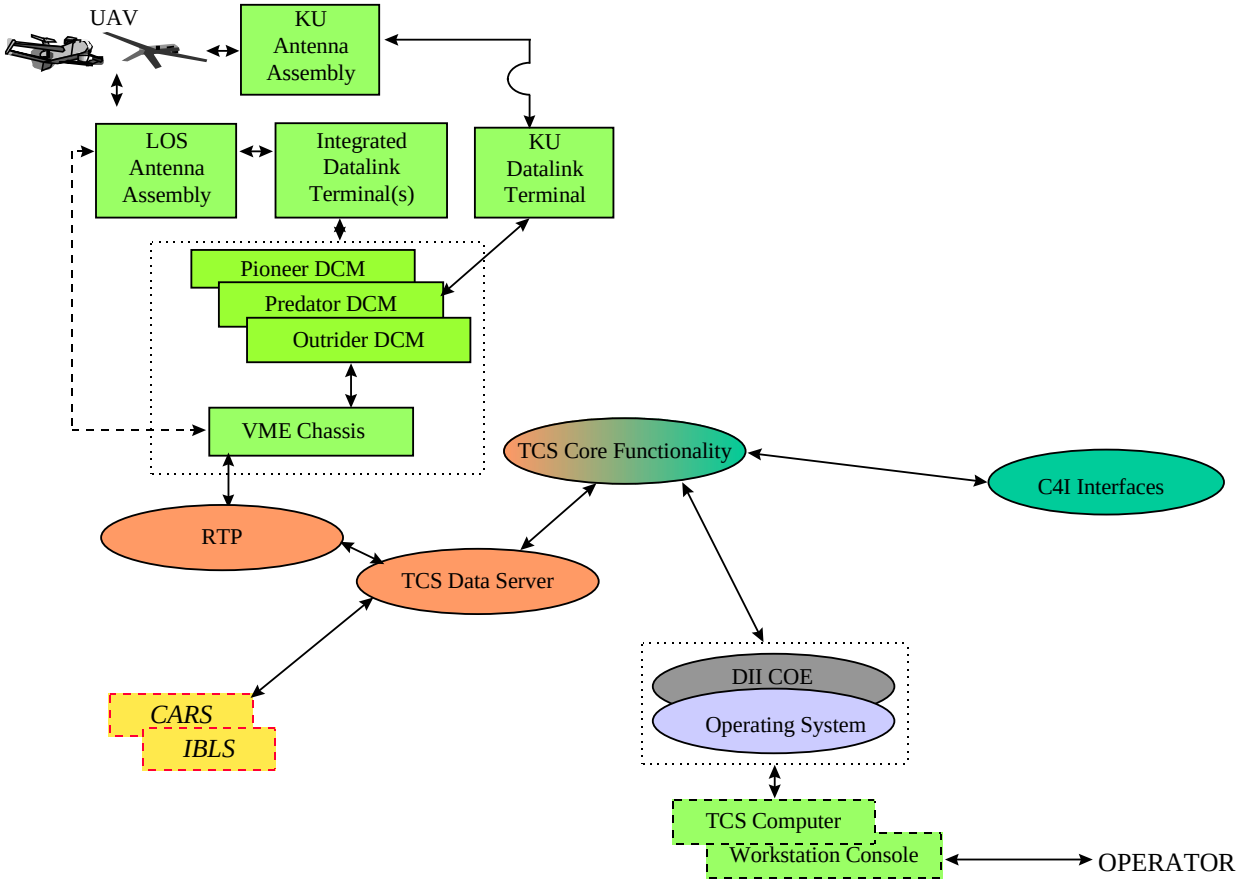

Figure 4.2.1.1.7-1 AV Recovery Data Flow Diagram

4.2.1.1.9 AV(s) Monitoring

This activity involves the Datalink Terminal HWCI, TCS Computer HWCI, TCS Core Functionality CSCI, and the Work Station Console HWCI to allow the operator to monitor the AV. This activity is initiated upon establishing communication with an AV. Once communication is established the Datalink Terminal HWCI continuously relays AV data to the TCS Core Functionality CSCI. The TCS Core Functionality CSCI processes this information and presents it to the operator. This activity is only completed when the AV is recovered or control of the AV is transferred to another TCS. The data received is logged by the TCS Core Functionality CSCI.

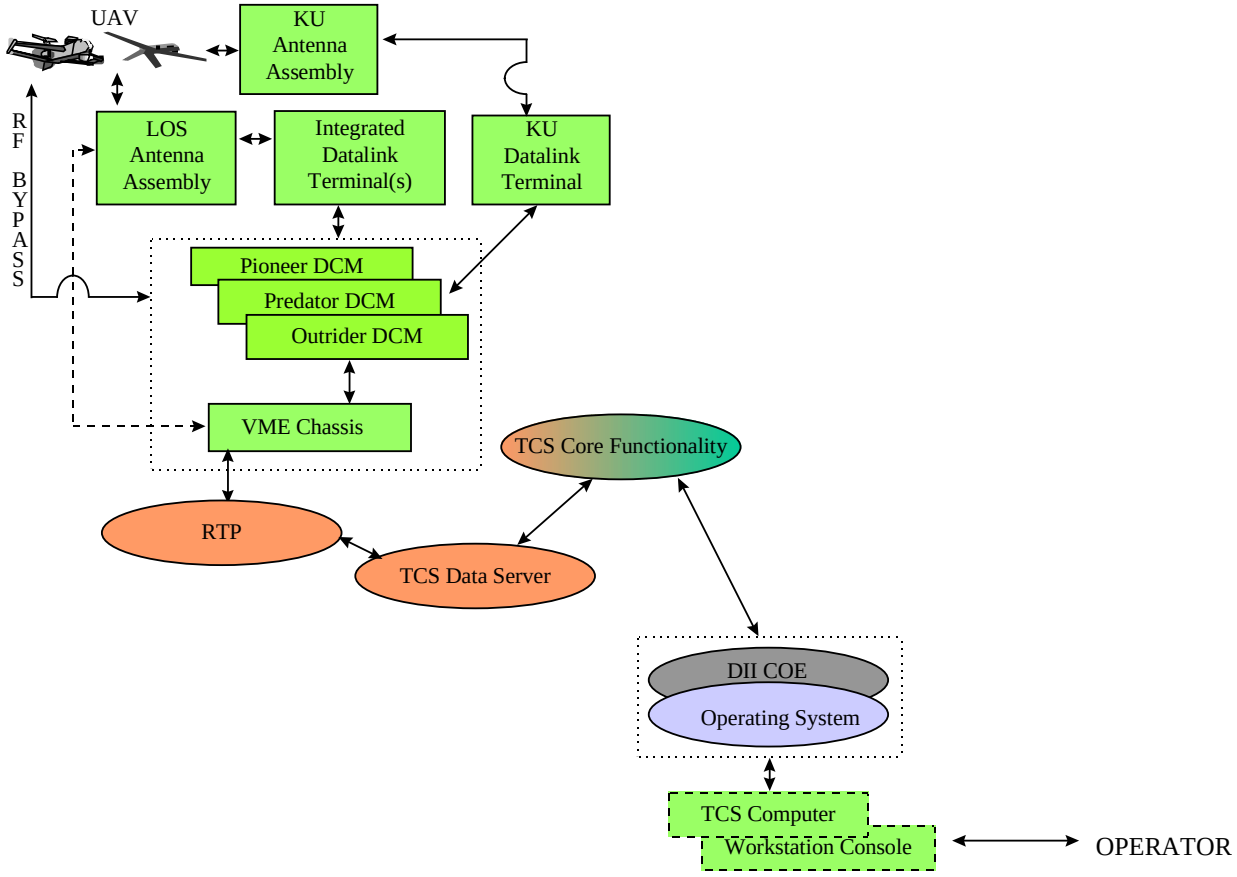

Figure 4.2.1.1.9-1 TCS AV Monitor Data Flow Diagram

4.2.1.1.10 AV(s) Control

This activity involves the Datalink Terminal HWCI, TCS Computer HWCI, TCS Core Functionality CSCI, and the Work Station Console HWCI to allow the operator to control the AV. This activity is initiated upon establishing communication with an AV. Once communication is established the Datalink Terminal HWCI relays AV flight commands from the TCS Core Functionality CSCI. This activity is only completed when the AV is recovered or control of the AV is transferred to another TCS. The commands transferred to the AV are logged by the TCS Core Functionality CSCI.

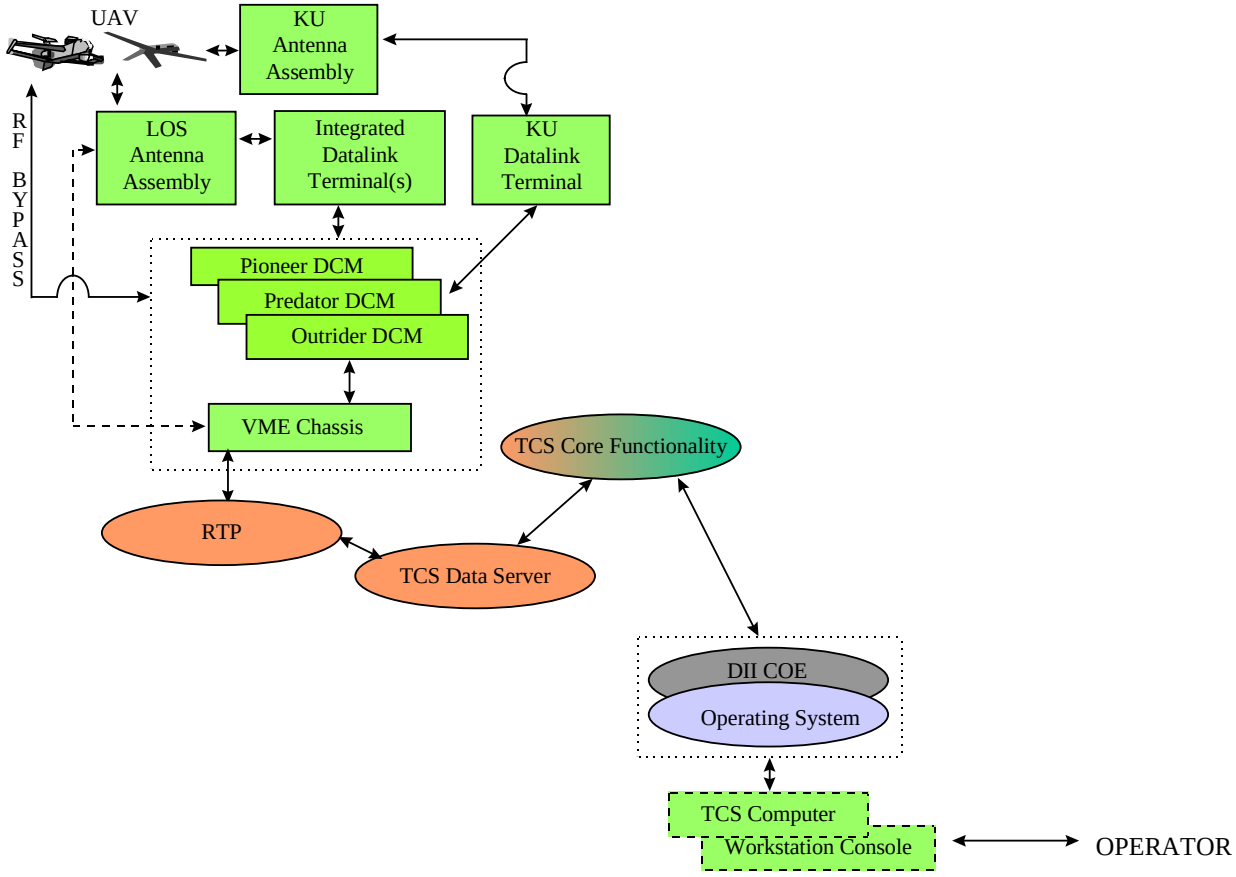

Figure 4.2.1.1.10-1 TCS AV Control Data Flow Diagram

4.2.1.1.11 Payload Monitoring

This activity involves the Datalink Terminal HWCI, TCS Computer HWCI, TCS Core Functionality CSCI, and the Work Station Console HWCI to allow the operator to monitor the Payload. This activity is initiated upon establishing communication with an AV. Once communication is established the Datalink Terminal HWCI continuously relays Payload data to the TCS Core Functionality CSCI. The TCS Core Functionality CSCI processes this information and presents it to the operator. This activity is only completed when the AV is recovered or control of the AV or Payload is transferred to another TCS. The data received is logged by the TCS Core Functionality CSCI.

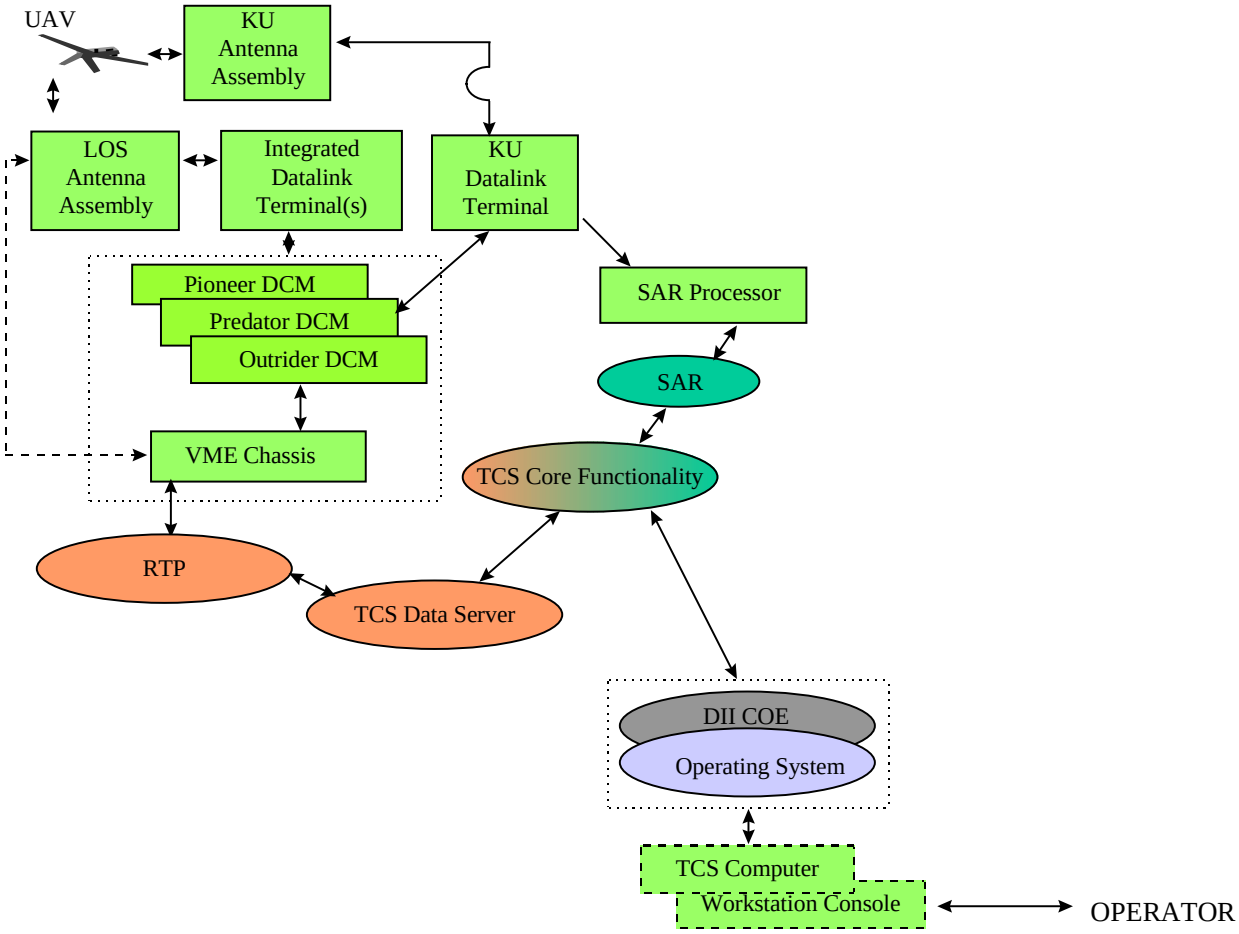

Figure 4.2.1.1.11-1 TCS Payload Monitoring Data Flow Diagram

4.2.1.1.12 Payload Control

This activity involves the Datalink Terminal HWCI, TCS Computer HWCI, TCS Core Functionality CSCI, and the Work Station Console HWCI to allow the operator to control the Payload. This activity is initiated upon establishing communication with an AV. Once communication is established the Datalink Terminal HWCI relays Payload commands from the TCS Core Functionality CSCI. This activity is only completed when the AV is recovered or control of the AV or Payload is transferred to another TCS. The commands transferred are logged by the TCS Core Functionality CSCI.

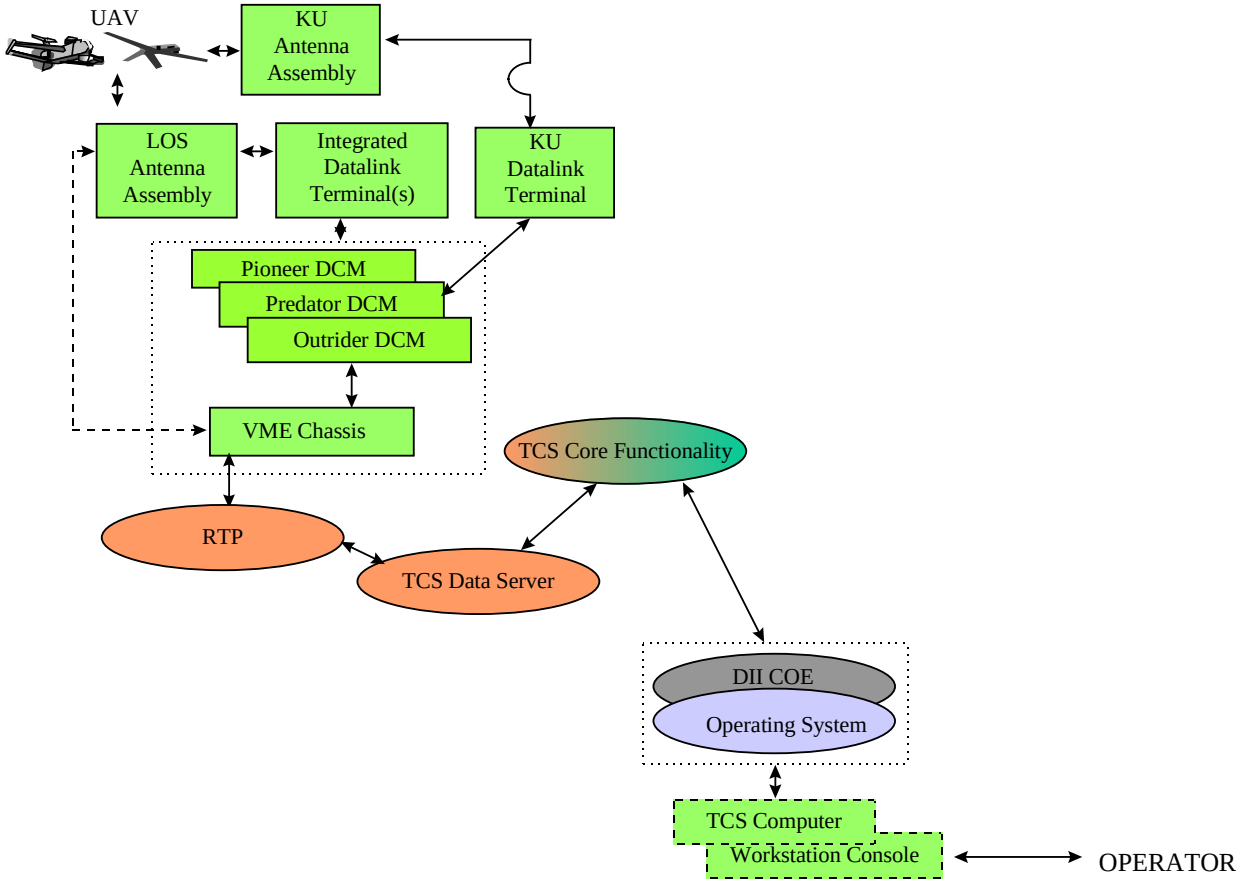

Figure 4.2.1.1.12-1 TCS Payload Control Data Flow Diagram

4.2.1.1.13 Payload Data Reception, Utilization, and Storage

This activity involves the Workstation Console HWCI, TCS Core Functionality CSCI, TCS Computer HWCI, Datalink Terminal HWCI, SAR Processor HWCI, SAR CSCI, VCR HWCI, Video Support Equipment HWCI, Printer HWCI, and External Storage HWCI. This activity is initiated upon establishing communication with an AV and determining that the Payload is operating. Once initiated the Datalink Terminal HWCI relays Payload data to the TCS Core Functionality CSCI.

When the Payload is a SAR, the SAR Processor HWCI and SAR CSCI will receive data from the Ku Datalink Terminal HWCI, process it, and send processed SAR data to TCS Core Functionality CSCI for further processing. The TCS Core Functionality CSCI presents the SAR data to the operator who determines what SAR data is to be processed for dissemination. A NITF 2.0 file may be created and stored for later utilization. Payload SAR imagery will be recorded on the Linear Tape Drive HWCI. This activity is completed when either the operator commands its completion or this activity for the Payload is transferred to another TCS.

When the Payload is an EO/IR, the Video Support HWCI will receive data from the Integrated

Datalink Terminal HWCI. The Video Support HWCI then routes the Payload Video to the VME Computer Assembly HWCI which processes it and sends the processed Video to the Workstation Console CSCI and on to the TCS Core Functionality CSCI for further processing. The TCS Core Functionality CSCI presents the Video to the operator who determines the video to be captured as a freeze frame for further processing and dissemination. A NITF 2.0 file will be created from the freeze frame video and associated telemetry data and stored for later utilization. EO/IR video imagery will be recorded on the VCR HWCI. This activity is completed when either the operator commands its completion or this activity for the Payload is transferred to another TCS.

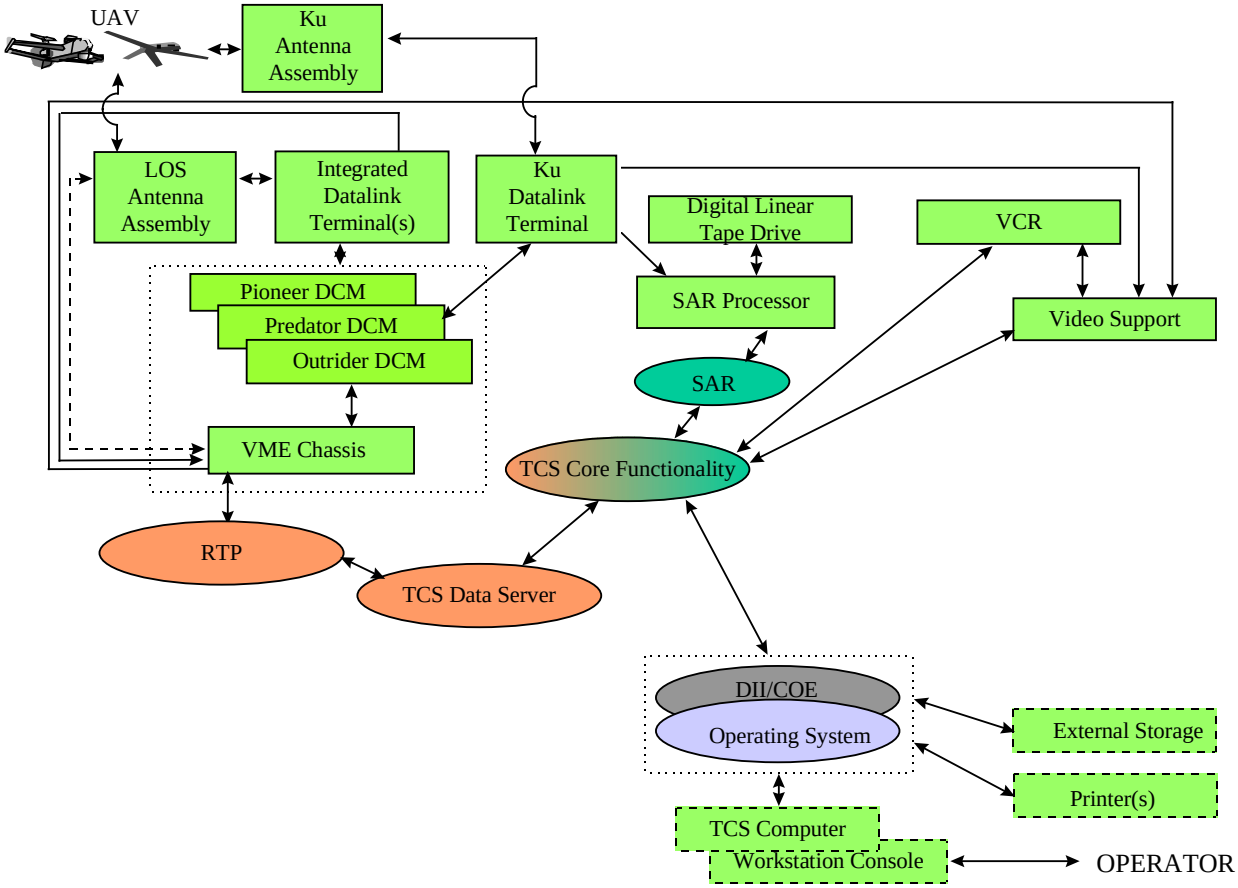

Figure 4.2.1.1.13-1 Payload Data Reception, Utilization, and Storage Data Flow Diagram

4.2.1.1.14 Targeting

This is a specific utilization of Payload data that involves the TCS Core Functionality CSCI and Workstation Console HWCI. This activity is initiated when the operator determines that a possible target exists and commands the TCS Core Functionality CSCI to develop accurate target coordinates and target location error estimates. The Targeting information is presented to the operator who determines when and if the Targeting information is transmitted to external C4I systems. This activity is completed when

accurate Targeting information is produced.

4.2.1.1.15 Datalink Monitoring

This activity involves the Datalink Terminal HWCI, TCS Computer HWCI, TCS Core Functionality CSCI, and the Workstation Console HWCI to allow the operator to monitor the Datalink(s). This activity is initiated when the Datalink is established. Once initiated the Datalink Terminal HWCI continuously relays Datalink data it receives to the TCS Core Functionality CSCI. The TCS Core Functionality CSCI processes this information and presents it to the operator. This activity is completed when the Datalink is deactivated. The TCS Core Functionality will log datalink status information.

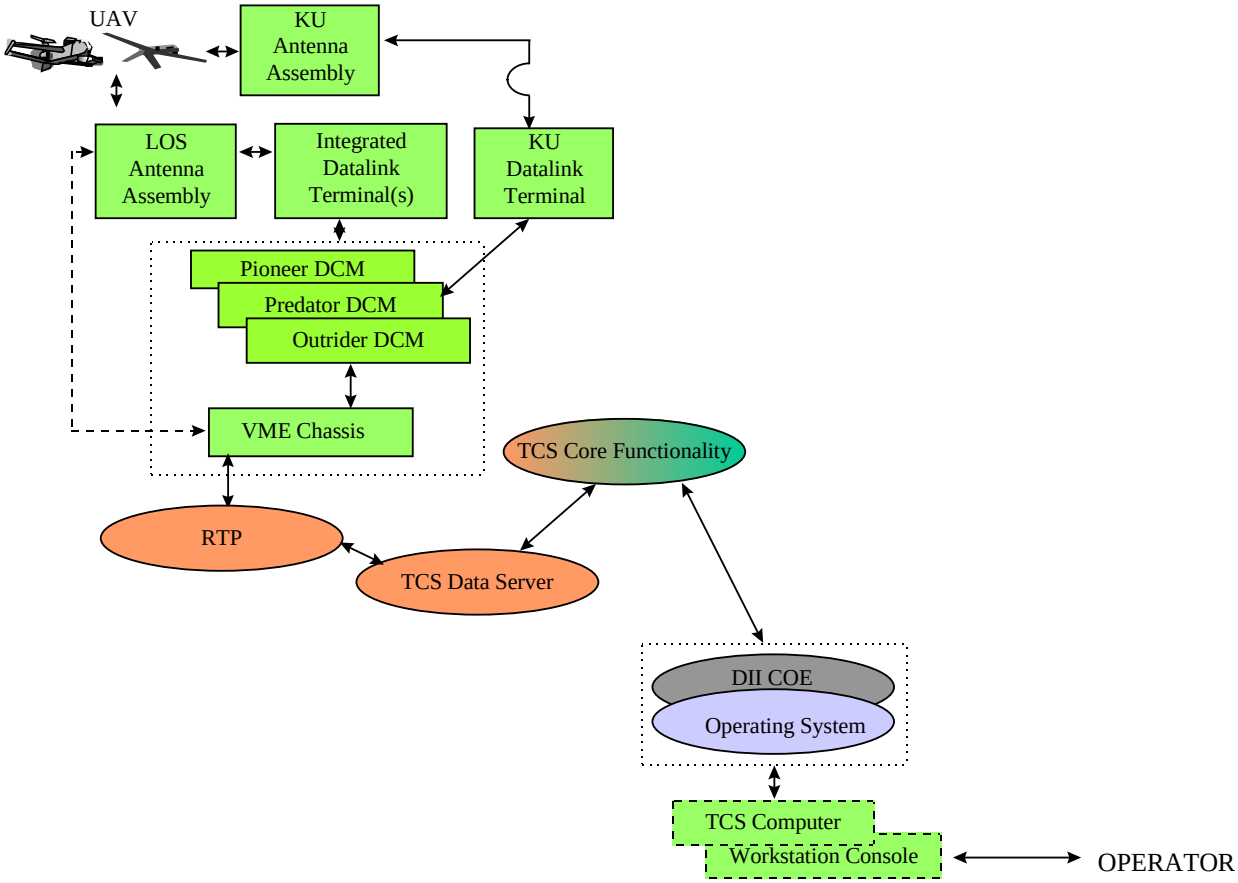

Figure 4.2.1.1.15-1 TCS Datalink Monitoring Data Flow Diagram

4.2.1.1.16 Datalink Control

This activity involves the Datalink Terminal HWCI, TCS Computer HWCI, TCS Core Functionality CSCI, and the Workstation Console HWCI to allow the operator to control the Datalink(s). This activity is initiated when the Datalink is established. Once initiated the TCS Core Functionality CSCI relays

commands to the Datalink. This activity is completed when the Datalink is deactivated. The TCS Core Functionality will log datalink command messages.

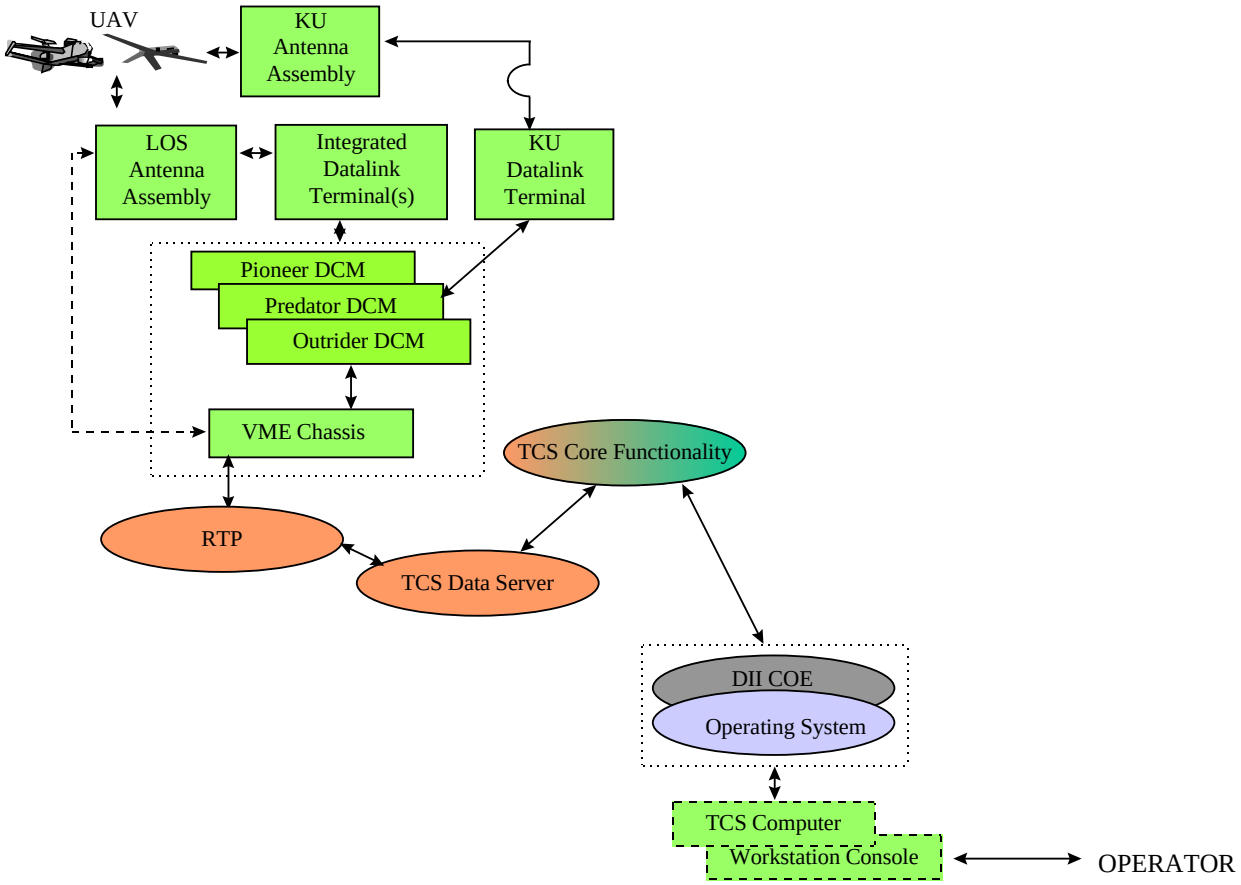

Figure 4.2.1.1.16-1 TCS Datalink Control Data Flow Diagram

4.2.1.1.17 Mission Planning

This activity involves the Workstation Console HWCI, TCS Mission Planner CSCI, DII/COE CSCI, C4I Interfaces CSCI, TCS Core Functionality CSCI, and TCS Computer HWCI to allow the operator to plan, store, and retrieve Mission Plans. This activity is initiated when the operator selects the mission planning activity to commence. The TCS Mission Planner CSCI will perform the mission planning actions entered by the operator and perform the appropriate display processing to provide feedback to the operator on the mission plan. The C4I Interfaces CSCI and the TCS Mission Planner will be able to transmit and receive Mission Plans. This activity is completed when the operator commands its completion.

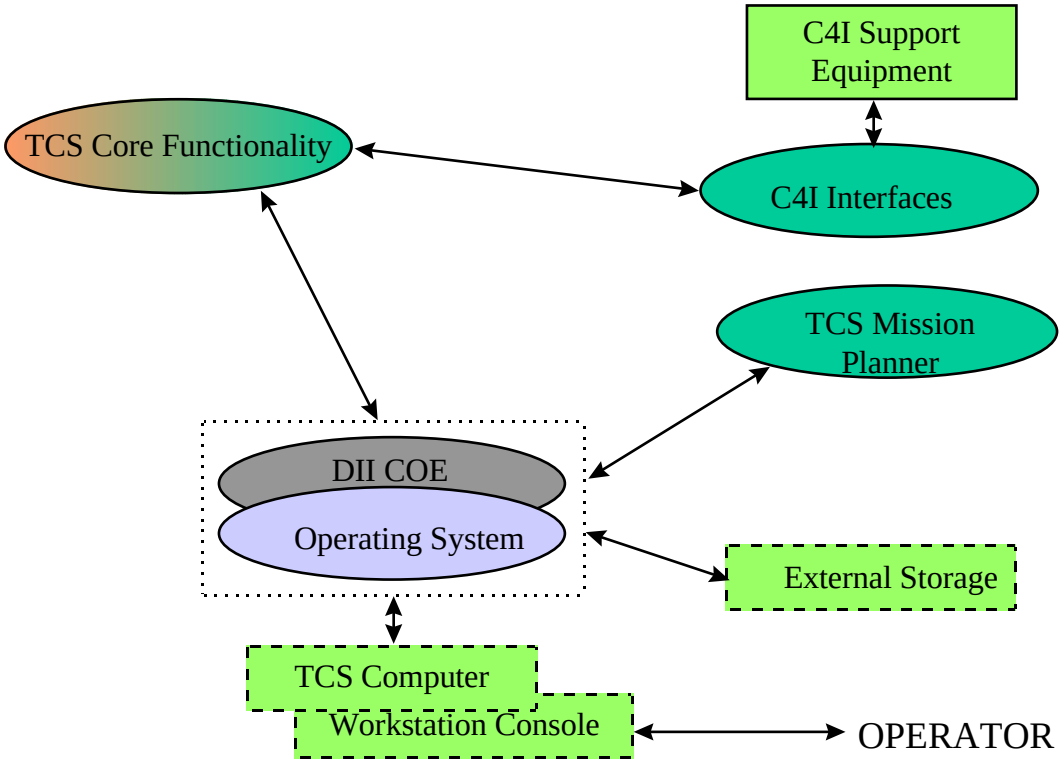

Figure 4.2.1.1.17-1 TCS Mission Planning Data Flow Diagram

4.2.1.1.18 VCR Control

This activity involves the Workstation Console HWCI, TCS Core Functionality CSCI, TCS Computer HWCI, and VCR HWCI to allow the operator to control the VCR. This activity is initiated when the operator selects the VCR control activity to commence. TCS Core Functionality CSCI will relay VCR commands entered by the operator and perform the appropriate display processing to provide feedback to the operator. This activity is completed when the operator commands its completion.

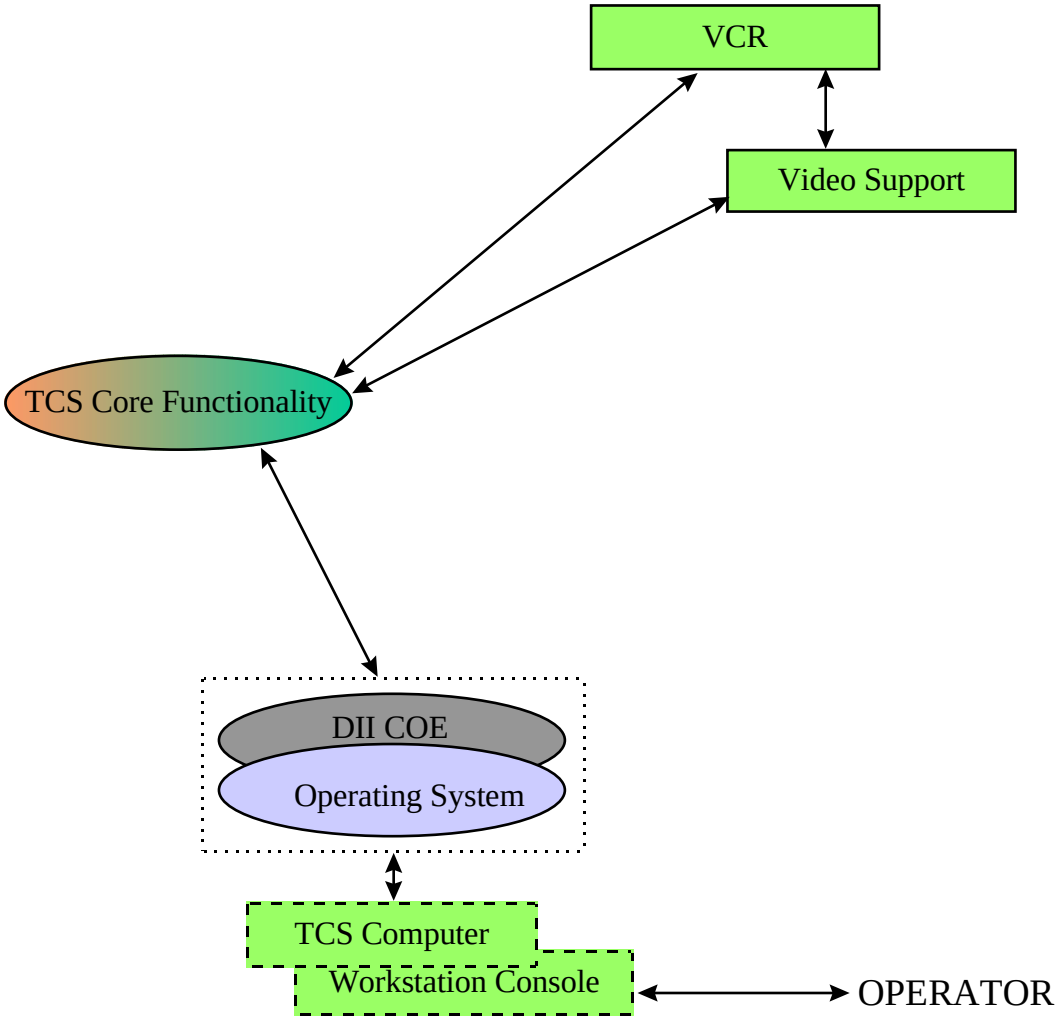

Figure 4.2.1.1.18-1 TCS VCR Control Data Flow Diagram

4.2.1.1.19 Printer Control

This activity involves the Workstation Console HWCI, DII/COE CSCI, TCS Core Functionality CSCI, TCS Computer HWCI, and Printer HWCI to allow the operator to print designated information. This activity is initiated when the operator selects information to be printed. The TCS Core Functionality will allow the operator to designate what information is to be printed. The DII/COE CSCI will provide the Printer HWCI commands and relay the information to the Printer HWCI to be printed and provide the appropriate feedback to the TCS Core Functionality and the operator. This activity is completed when the Printer HWCI has printed the information.

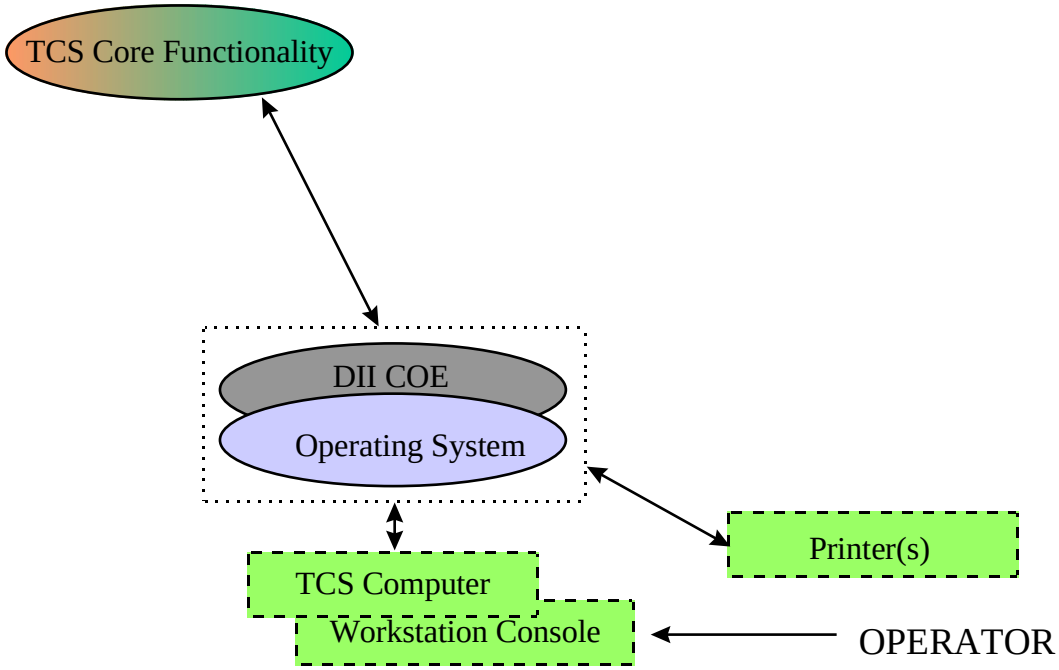

Figure 4.2.1.1.19-1 TCS Printer Control Data Flow Diagram

4.2.1.1.20 Voice Input/Output Communication

4.2.1.1.21 TCS to TCS Communication

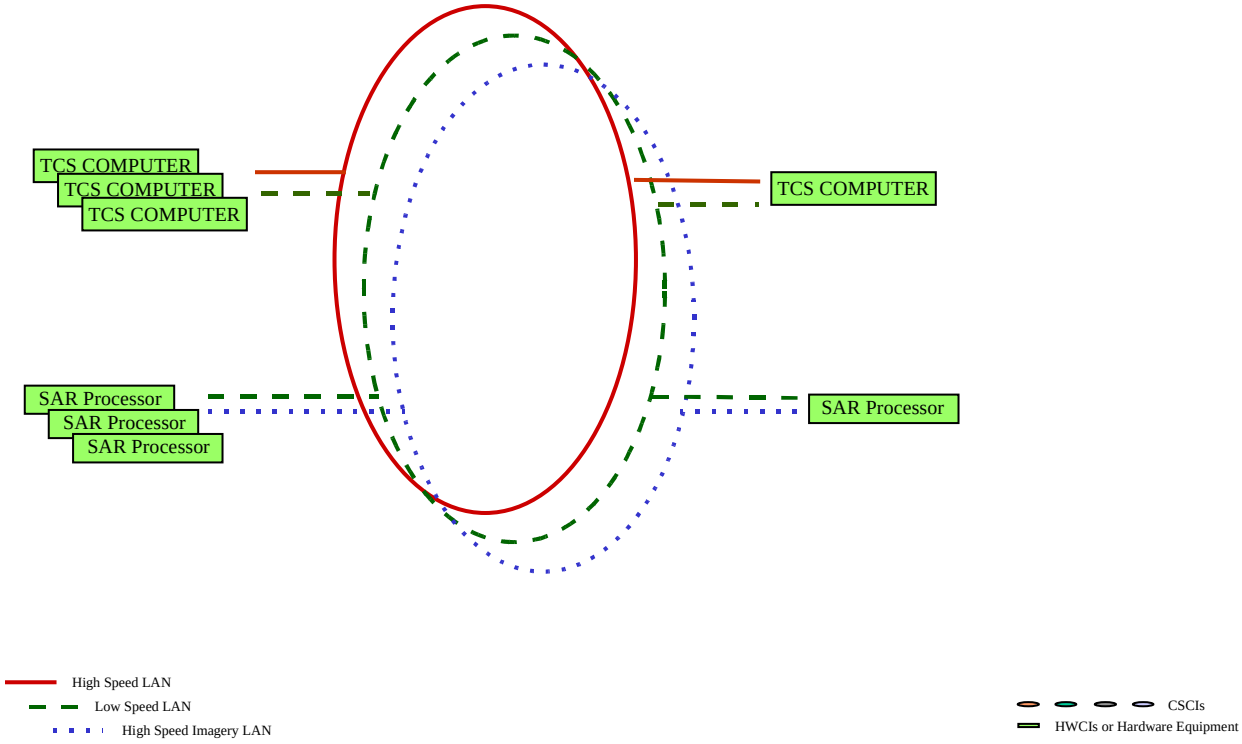

Figure 4.2.1.1.21-1 TCS to TCS Communication Data Flow Diagram

4.2.1.1.22 Analog Video Input/Output

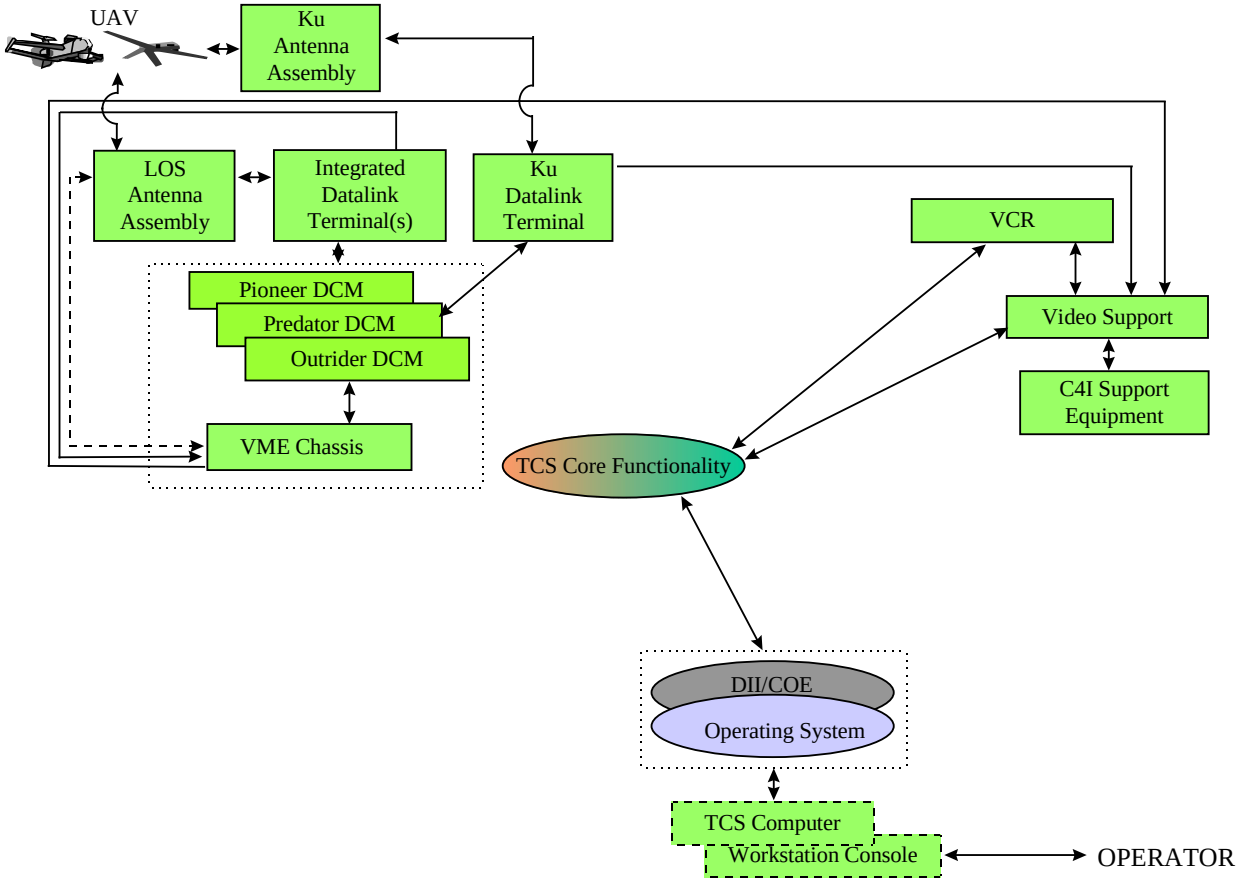

Figure 4.2.1.1.22-1 TCS Analog Video Input/Output Data Flow Diagram

4.2.1.1.23 External LAN

Growth item

4.2.1.2 Training Mode Execution

The purpose of the Training Mode is to provide the operator capability to train at any level of interaction regardless of the TCS hardware configuration. (SSS) [SSDD689). All of the following CSCIs shall be capable of executing concurrently.(SSS) [SSDD690]

1. TCS Core Functionality CSCI
2. TCS Mission Planner CSCI
3. C4I Interfaces CSCI
4. DII/COE CSCI

5. Operating System

6. TCS Data Server CSCI

TCS training and training support shall include the processes, procedures, techniques, training devices and equipment to train civilian, active duty and reserve military personnel to operate and support the TCS system. (SSS49) [SSDD691

The TCS system shall provide, for the operator and maintainer, an embedded or add-on interactive training courseware with self-paced instruction, duplicating UAV flight performance characteristics, capabilities, and limitations. (SSS492) [SSDD692]

The Outrider TCS system shall be compatible with the U.S. Army Intelligence and Electronic Warfare Tactical Proficiency Trainer as an objective. (SSS493) [SSDD693]

The interactive courseware training capability for TCS shall be developed during Phase I and introduced to the user during scheduled demonstrations and tests. (SSS494) [SSDD694]

The training capability for performance of TCS functions shall include primary mission (flight route/payload) planning, mission control and monitoring, imagery processing, tactical communications, AV control communications and TCS system on line diagnostics. (SSS495) [SSDD695]

The TCS shall provide the functional capability to train personnel in the operation of the TCS system, performance of TCS UAV functions, and on-line system troubleshooting. (SSS496) [SSDD696]

TCS system training shall include system architecture, component familiarization, and system startup, initialization, system recovery, on-line diagnostics, and shutdown. (SSS497) [SSDD697]

The TCS system shall not be required to support Training operations concurrent with the execution of an actual mission. (SSS499) [SSDD698]

The capability for the conduct of actual communications processing concurrently with Training operations shall be provided if and only if messages are identified as training messages. (SSS500) [SSDD699]

Training shall be adequate to maintain operator and maintainer skills and proficiencies.(SSS501) [SSDD700]

TCS shall record operator and maintainer actions for self assessment and performance enhancement. (SSS502) [SSDD701]

Operator and maintainer performance shall be measurable using parameters retrievable from the TCS to determine proficiency levels. (SSS503) [SSDD702]

In the Training Operations Mode the TCS shall support the following functions: (SSS039) [SSDD703]

1. Mission Planning

2. Mission Control and Monitoring
3. Payload Product Management
4. Target Coordinate Development
5. C4I Systems Interface

Functions under the Training Operations Mode shall operate concurrently without precluding or excluding any of the other functions, in accordance with allowable operations as determined by the appropriate levels of interaction. (SSS040) [SSDD704]

4.2.1.3 Maintenance Mode Execution

In the Maintenance Operations Mode the TCS Core Functionality CSCI shall support the following functions:

1. Conduct AV maintenance (SSS041)[SSDD705]
2. Conduct payload maintenance (SSS041)[SSDD706]
3. Conduct Data Link Terminal maintenance (SSS041)[SSDD707]
4. Conduct workstation and peripheral equipment maintenance(SSS041)[SSDD708]
5. Perform Fault Detection/Location (FD/L) (SSS041)[SSDD709]
6. Perform Software Upgrades(SSS041)[SSDD710]
7. Perform Software Debug and Monitoring (SSS041)[SSDD711]

Functions, except for software upgrade and software debug, under the Maintenance Operations Mode shall operate concurrently without precluding or excluding any of the other functions in accordance with allowable operations as determined by the appropriate levels of interaction. (SSS042) [SSDD712

4.2.2 Configuration Item (CI) Priorities

Configuration Items associated with AV control and monitoring shall have the highest priority. These include Core Functionality CSCI, Operating System CSCI, TCS Computer HWCI, Ku Datalink Terminal HWCI, VME Computer Assembly HWCI, LOS Antenna Assembly HWCI, Ku Antenna Assembly HWCI, Data Control Module HWCIs, and the Integrated Datalink Terminal HWCI. Configuration Items associated with Payload control and monitoring shall have second highest priority. These include tbd. Configuration Items associated with sending and receiving C4I messages and analog video shall have the third highest priority. These CIs include tbd. Configuration Items associated with storing Payload information shall have fourth highest priority. These CIs include tbd. Configuration Items associated with voice communication shall have fifth highest priority.

4.2.3 Interrupt Handling

Interrupt handling shall not impede mission performance. Message alerts shall be presented in a manner so as not to interrupt mission performance. Life threatening alerts shall be presented in accordance with MIL-STD-1472 with appropriate color coding and use of flashing where determined

necessary. Where interrupts occur because of subsystem or system failures, the corresponding system status shall be presented in the alert portion of the display screen. System status shall be presented at the operator's discretion based on criticality and component priorities to the mission. Core Functionality CSCI shall handle all interrupts except for printer and C4I interrupts. The printer interrupt(s) shall be handled by the Operation system CSCI or DII/COE CSCI which ever is controlling the printer at the time. The C4I interrupts shall be handled by the C4I Interface CSCI.

4.2.4 Exception Handling

The system shall enable the operator(s) to manually override the software diagnostics where mission performance or completion are critical. The operator shall have command and control authority to perform dynamic retasking and decision control over mission or system.

The system shall enable the operator(s) to manually override the software diagnostics where mission performance or completion are critical. The operator shall have command and control authority to perform dynamic retasking and decision control over mission, or system exceptions.(SSS067) [SSDD713]

The TCS shall provide the capability to override validation faults after the fault is acknowledged by the operator.(SSS540) [SSDD714]

4.3 Interface Design

The TCS design has both internal and external interfaces that are necessary for the proper operation of the system. The internal interfaces are between the various components (CSCIs and HWCIs) of the TCS as shown in Figure 4.1-3, TCS Component Architecture. The external interfaces (inputs and outputs) are between the TCS and various support equipment as shown in Figure3.1-1 TCS Inputs and Outputs and re 4.1-1 TCS Hardware Architecture.

4.3.1 TCS Interface Identification

4.3.1.1 TCS Component Interfaces

As shown in Figures 4.1-1 through 4.1-3, the TCS Component Architecture has the following types of component (CSCI and HWCI) interfaces: Software to Software, Software to Hardware, and Hardware to Hardware.

4.3.1.1.1 Software to Software Interfaces

The TCS will have the following software to software interfaces:

1. DII/COE to TCS Core Functionality
2. DII/COE to TCS C4I Interfaces
3. DII/COE to Mission Planning
4. TCS Data Server to TCS Core Functionality
5. TCS Data Server to TCS Mission Planner

6. TCS Core Functionality to C4I Interfaces

4.3.1.1.2 Software to Hardware Interfaces

The TCS will have the following software to hardware interfaces:

1. DII-COE to Internal Printer
2. DII-COE to External Printer
3. DII-COE to External Storage
4. Operating System to TCS Computer
5. C4I Interfaces to C4I Support Equipment
6. TCS Core Functionality to Video Support
7. TCS Core Functionality to VCR
8. TCS Core Functionality to SAR Processor
9. TCS Data Server to DCMs (AV Standard Interface)
10. TCS RTP to CARS
11. TCS RTP to IBLS

4.3.1.1.3 Hardware to Hardware Interfaces

The TCS will have the following hardware to hardware interfaces:

1. TCS Computer to C4I Support Equipment
2. TCS Computer to Printer
3. TCS Computer to Video Support
4. TCS Computer to VCR
5. Video Support to VCR
6. TCS Computer to SAR Processor
7. TCS Computer to VME Computer Assembly
8. VME Computer Assembly to DCMs
9. TCS Computer to Co-located TCS Computer(s)
10. DCMs to IDT
11. IDT to LOS Antenna Assembly
12. SAR Processor to Ku Datalink Terminal
13. VME Computer Assembly to LOS Antenna Assembly
14. DCM to Ku Antenna Assembly
15. SAR Processor to Linear Digital Tape Drive
16. TCS Computer to External Data Storage
17. Ku Datalink Terminal to Ku Antenna Assembly
18. IDT to VME Computer Assembly
19. Ku Datalink Terminal to VME Computer Assembly
20. VME Computer Assembly to Video Support
21. TCS Computer to Operator Output
22. TCS Computer to Operator Input

4.3.1.2 TCS External Interfaces

4.3.1.2.1 C4I Interfaces

The TCS shall interface with the following C4I systems:

1. Radio data burst connectivity to Automatic Target Hand-off Systems (ATHS)
2. Advanced Field Artillery Tactical Data Systems (AFATDS)
3. Army Deep Operations Coordination System (ADOCS)
4. Wire connectivity to the All Source Analysis System (ASAS)
5. The Intelligence Analysis System (IAS)
6. The Joint Standoff Target Attack Radar System (JSTARS) Ground Station Module/Common Ground Station (GSM/CGS)
7. The Joint Maritime command Information System (JMCIS)
8. Closed Circuit Television (CCTV)
9. Advanced Tomahawk Weapons Control Station (ATWCS)
10. Joint Deployable Intelligence Support System (JDISS)
11. Trojan Special Purpose Integrated Remote Intelligence Terminal (SPIRIT) II
12. Joint Service Imagery Processing System (JSIPS)
13. JSIPS Tactical Exploitation Group (JSIPS TEG)
14. Tactical Exploitation System (TES)
15. Service Mission Planners
16. The Theater Battle Management Core System (TBMCS)
17. The Guardrail Common Sensor Aerial Common Sensor (ACS) Integrated Processing Facility (IPF)
18. Modernized Imagery Exploitation System (MIES)
19. Enhanced Tactical Radar Correlator (ETRAC)
20. Contingency Airborne Reconnaissance System (CARS)
21. Common Operational Modeling, Planning, and Simulation System (COMPASS)

4.3.1.2.2 Power Interfaces

The TCS will have the following power interfaces:

1. UPS to Power
2. TCS Computer to UPS
3. Datalink Command Modules to UPS

4.3.1.2.3 Imagery System Interfaces

The TCS will have the following imagery interfaces:

1. TCS Computer to Image Product Library
2. TCS Computer to Direct Dissemination Element (DDE)

4.3.1.2.4 Launch and Recovery Interfaces

1. VME Computer Assembly to Common Automated Recovery System (CARS)
2. VME Computer Assembly to Integrated Beacon Landing System (IBLS)

4.3.2 Interface Characteristics

4.3.2.1 TCS Component Interface Characteristics

4.3.2.1.1 Software to Software Interface Characteristics

All TCS software interface characteristics will be defined and specified by the TCS Software Design Document, TCS XXX and the TCS Data Server Interface Design Description, TCS XXX.

4.3.2.1.2 Software to Hardware Interfaces Characteristics

4.3.2.1.2.1 DII/COE to Internal Printer

An interface shall exist so that the DII-COE CSCI can pass information to an internal printer. (SSS314) [SSDD715]

This interface will consist of printer commands from the DII/COE to the printer, and status information from the printer to DII/COE.

This interface in not flight critical nor mission critical and is designated as a low priority.

The interface characteristics for the internal printer will be defined and specified by the TCS to Printer IDD, TCS XXX

4.3.2.1.2.2 DII-COE to External Printer

An interface shall exist so that the DII-COE CSCI can pass information to an external printer. (SSS314) [SSDD716]

This interface will consist of printer commands from the DII/COE to the printer, and status information from the printer to DII/COE.

This interface in not flight critical nor mission critical and is designated as a low priority.

The interface characteristics for the external printer will be defined and specified by the TCS to Printer IDD, TCS XXX

4.3.2.1.2.3 DII-COE to External Storage

An interface shall exist so that the DII/COE CSCI can pass digital data to an external storage device. (SSS317)] [SSDD717]

This interface will consist of the transmission of storage and retrieval commands from the DII/COE CSCI to the External Storage HWCIs, and status information from the External Storage HWCIs to the DII/COE CSCI.

This interface in not flight critical nor mission critical and is designated as a low priority.

The interface characteristics for the external storage will be defined and specified by the TCS to External Storage IDD, TCS XXX

4.3.2.1.2.4 Operating System to TCS Computer

An interface will exist between the Operating System CSCI and the TCS Computer HWCI.

This interface will consist of the transmission of standard communications that occur between an operating system and its associated hardware platform.

This interface is flight critical and mission critical and is designated as a high priority interface.

The Operating System CSCI and the TCS Computer HWCI interface will be defined and specified by the associated manufacture's design documentation.

4.3.2.1.2.5 C4I Interfaces to C4I Support Equipment

The C4I Interfaces CSCI to C4I Support Equipment HWCI interface shall pass information to and from standard DoD tactical (VHF, UHF, and UHF/VHF) radios, Mobile Subscriber Equipment, and military and commercial satellite communications equipment. (SSS285) [SSDD718]

The C4I Interfaces CSCI to C4I Support Equipment HWCI Interface shall pass information to and from external mission tasking systems (e.g., receive tasking orders, coordinate mission certification). [SSS286]

This interface is not flight critical but is mission critical and is designated as a medium priority interface.

The C4I Interfaces CSCI to C4I Support Equipment HWCI interface will be defined and specified by the TCS to C4I Support Equipment Interface Design Description, TCS XXX.

4.3.2.1.2.6 TCS Core Functionality to Video Support

An interface will exist between the TCS Core Functionality CSCI to Video Support HWCI.

This interface will consist of the transmission of video associated commands from the TCS Core Functionality CSCI t to Video Support HWCI, and status and analog imagery information from the Video Support HWCI to TCS Core Functionality CSCI.

This interface is not flight critical but is mission critical and is designated as a medium priority interface.

The TCS Core Functionality CSCI t to Video Support HWCI interface will be defined and specified by the TCS Analog Imagery Interface Design Description, TCS XXX.

4.3.2.1.2.7 TCS Core Functionality to VCR

A TCS Core Functionality CSCI to VCR HWCI interface shall exist such that commands from the TCS Core Functionality CSCI to the VCR HWCI and status data can be routed from the VCR HWCI to the TCS Core Functionality CSCI. (SSS335) [SSDD719]

This interface is not flight critical and is not mission critical and is designated as a low priority interface.

The TCS Core Functionality CSCI t to Video Support HWCI interface will be defined and specified by the TCS to VCR Interface Design Description, TCS XXX.

4.3.2.1.2.8 SAR to SAR Processor

The SAR CSCI will have an interface with the SAR Processor HWCI.

This interface will consist of the transmission of standard communications that occur between software and its associated hardware platform.

This interface is not flight critical but is mission critical and is designated as a medium priority interface.

The SAR CSCI to SAR Processor HWCI interface will be defined and specified by the associated manufacture's design documentation.

4.3.2.1.2.9 TCS Data Server to DCMs (AV Standard Interface)

The TCS Data Server CSCI shall provide the system functionality necessary to interface with the AV specific DCM HWCIs. (SSS312) [SSDD720]

The TCS Data Server CSCI to DCM HWCI interface shall provide the proper data format to ensure communications with the selected AV. (SSS322) [SSDD721]

TCS Data Server CSCI to DCM HWCI interface shall allow for addition of future AVs and will provide the generic architecture to ensure interoperability. (SSS323) [SSDD722]

The uplink and downlink information passed between the TCS and the AV over the TCS Data Server CSCI to DCM HWCI interface shall be in accordance with the associated AV documentation. (SSS324) [SSDD723]

This interface is flight critical and mission critical and is designated a high priority interface.

The TCS Data Server CSCI t to DCM HWCIs interface will be defined and specified by the TCS AVSI Interface Design Description, TCS XXX.

4.3.2.1.2.10 TCS RTP to CARS

The TCS RTP CSCI shall interface with the CARS HWCI (SSS137) [SSDD724]

This interface will consist of the transmission of AV recovery information and CARS status from the CARS HWCI to the RTP CSCI, and operational commands from the RTP CSCI to the CARS HWCI.

This interface is flight critical and mission critical and is designated a high priority interface.

The TCS RTP CSCI to CARS HWCI interface will be defined and specified by the TCS CARS Interface Design Description, TCS XXX.

4.3.2.1.2.11 TCS RTP to IBLS

The TCS RTP CSCI will interface with the IBLS HWCI. (SSS136) [SSDD725]

This interface will consist of the transmission of AV recovery information and IBLS status from the IBLS HWCI to the RTP CSCI, and operational commands from the RTP CSCI to the IBLS HWCI.

This interface is flight critical and mission critical and is designated a high priority interface.

The TCS RTP CSCI to IBLS HWCI interface will be defined and specified by the TCS IBLS Interface Design Description, TCS XXX.

4.3.2.1.2.12 RTP to VME Computer Assembly

The RTP CSCI will have an interface with the VME Computer Assembly HWCI.

This interface will consist of the transmission of standard communications that occur between software and its associated hardware platform.

This interface is flight critical and mission critical and is designated as a high priority interface.

The RTP CSCI to VME Computer Assembly HWCI interface will be defined and specified by the associated manufacture’s design documentation.

4.3.2.1.3 Hardware to Hardware Interfaces Characteristics

4.3.2.1.3.1 TCS Computer to C4I Support Equipment

The TCS Computer will interface to the required C4I Support Equipment in order to provide the functionality to send tactical communication messages.

This interface will consist of the receipt and transmittal of C4I communication messages from the TCS Computer to the required C4I Support Equipment.

The TCS Computer to C4I Support Equipment interface is not a flight critical interface but is crucial to the mission and is designated a medium priority interface.

This interface will be defined and specified in TBD.

4.3.2.1.3.2 TCS Computer to Printer

A physical interface shall exist between the TCS Computer HWCI and the Internal Printer HWCI. (SSS314) [SSDD726]

The TCS Computer HWCI shall have ports for outputting data and imagery to an Internal Printer HWCI. (SSS337) [SSDD727]

The TCS Computer to Internal Printer is not flight critical nor mission critical and is designated as a low priority interface.

The interface characteristics for the internal printer will be defined and specified by the TCS to Printer IDD, TCS XXX

4.3.2.1.3.3 TCS Computer to Video Support

The TCS Computer shall provide an interface to the Video Support Equipment to include as a minimum a video switch.

The interface will consist of digital control information from the TCS Computer to the Video Support equipment (video switch), information from the Video Support equipment to the TCS Computer, the transmittal of raw video (RS-170A) from the Video Support equipment to the TCS, transmittal of video with as well as without overlay, and the transmittal of annotated video from the TCS computer to the Video Support equipment.

The interface is not flight critical but is mission crucial and is designated as a medium priority interface.

The interface characteristics for the video support will be defined and specified by the TCS to Video Support IDD, TCS XXX

4.3.2.1.3.4 TCS Computer to VCR

The TCS Computer shall provide an interface to a VCR. (SSS333) [SSDD728]

The interface will consist of digital control information from the TCS Computer to the VCR and status information from the VCR to the TCS Computer.

This interface is not flight critical, but is mission crucial and is designated as a medium priority interface.

The interface characteristics for the VCR will be defined and specified by the TCS to VCR Control IDD, TCS XXX

4.3.2.1.3.5 Video Support to VCR

The Video Support will have an interface to a VCR.

This interface will consist of video (RS-170A) storage to the VCR and video retrieval from the VCR

This interface is not flight critical but is mission crucial and is designated as a medium priority interface.

The Video Support to VCR interface will be defined and specified in the TCS to Analog Imagery Interface Design Description, TCS XXX

4.3.2.1.3.6 TCS Computer to SAR Processor

The TCS Computer shall interface with the SAR Processor. (SSS330) [SSDD728]

This interface will consist of SAR information receipt (imagery and telemetry) to the TCS Computer.

This interface is not flight critical but is mission crucial and is designated a medium priority interface.

The TCS Computer to SAR Processor interface will be defined and specified in the TCS to SAR Processor IDD, TCS XXX.

4.3.2.1.3.7 TCS Computer to VME Computer Assembly Interface

The TCS Computer will provide an interface to the VME Computer Assembly.

This interface is flight critical and mission crucial and is designated as a high priority interface.

This interface will be defined and specified by TBD.

4.3.2.1.3.8 VME Computer Assembly to Datalink Command Modules

The TCS Computer HWCI shall provide the system functionality necessary to interface with the DCMs. (SSS312) [SSDD729]

This interface will consist of the data elements and messages as defined in the TCS AV Standard Interface, TCS 229.

This interface is a flight critical and mission crucial interface and is designated as a high priority

interface.

The TCS to DCM interfaces will be defined and specified by the TCS Datalink Control Module (DCM) Hardware development Specification, TCS XXX and the TCS to AV Standard Interface Design Description, TCS 229.

4.3.2.1.3.9 TCS Computer to Co-located TCS Computer(s)

The TCS Computer will provide the functionality to interface with a co-located TCS Computer to provide a distributed processing capability.

This interface is potentially a flight critical and mission crucial interface (depending on the operational situation) and is designated as a high priority interface.

This interface will be defined and specified by TBD

4.3.2.1.3.10 DCMs to IDT

The DCM will provide the functionality to interface with the IDT.

This interface will consist of the uplink of AV and payload commands that are generated by TCS, and the downlink of all AV and payload data from the IDT to the DCM.

This interface is flight critical and mission crucial and is designated as a high priority interface.

This interface will be defined and specified by TCS Datalink Control Module Hardware Development Specification, TCS XXX; the TCS DCM Interface Design Description, TCS XXX; and the TCS IDT Interface Design Description, TCS XXX

4.3.2.1.3.11 IDT to LOS Antenna Assembly

The IDT will provide an interface to the LOS Antenna Assembly.

This interface will consist of the transmission of uplink information from the IDT to the LOS Antenna Assembly, and the receipt of downlink information from the LOS Antenna Assembly to the IDT.

This interface is flight critical and mission crucial and is designated as a high priority interface.

The IDT to LOS Antenna Assembly interface will be define and specified in the TCS IDT Interface Design Description, TCS XXX.

4.3.2.1.3.12 SAR Processor to Ku Antenna Assembly

The SAR Processor will provide an interface to the Ku Antenna Assembly.

This interface will consist of the transmission of SAR Imagery from the Ku Antenna Assembly to

the SAR Processor.

This interface is not flight critical but is mission crucial and is designated as a medium priority interface.

The SAR Processor to Ku Antenna Assembly interface is defined and specified by the (TBD associated Northrop Grumman documentation).

4.3.2.1.3.13 VME Computer Assembly to LOS Antenna Assembly

The VME Computer Assembly will provide an interface to the LOS Antenna Assembly.

This interface will consist of the transmission of antenna pointing commands from the VME Computer Assembly to the LOS Antenna Assembly.

This interface is flight critical and mission crucial and is designated as a high priority interface.

The VME Computer Assembly to LOS Antenna Assembly interface will be defined and specified by the TCS to C Band LOS Antenna Control Interface Design Description, TCS XXX

4.3.2.1.3.14 DCM to Ku Antenna Assembly

The DCM will provide an interface to the Ku Antenna Assembly.

This interface will consist of the transmission of command and control information from the DCM to the Ku Antenna Assembly and the transmission of status information from the Ku Antenna Assembly to the DCM. Currently this interface only applies to the Predator DCM.

This interface is not flight critical but is mission crucial and is designated as a medium priority interface.

The DCM to Ku Antenna Assembly interface will be defined and specified in the TCS SATCOM Interface Design Description, TCS XXX

4.3.2.1.3.15 SAR Processor to Linear Digital Tape Drive

The SAR Processor will have an interface to a Linear Digital Tape Drive.

This interface will consist of the storage of SAR data from the SAR Processor to the LDT. retrieval of SAR data from the LDT to the SAR Processor.

This interface is not flight critical but is mission crucial and is designated as a medium priority interface.

This SAR Processor to Linear Digital Tape interface will be defined and specified in the TCS to SAR Processor Interface Design Description, TCS XXX.

4.3.2.1.3.16 TCS Computer to External Data Storage

The TCS Computer will provide and interface to access external data storage devices.

This interface will consist of the storage of data to the external storage device from the TCS Computer, and the retrieval of stored data from the external data storage device by the TCS Computer.

This interface is not flight critical but is mission crucial and is designated as a medium priority interface.

This interface will be defined and specified by the TCS to External Data Storage Interface Design Description, TCS XXX.

4.3.2.1.3.17 Ku Datalink Terminal to Ku Antenna Assembly

The Ku Datalink Terminal will interface with the Ku Antenna Assembly.

This interface will consist of the transmission of uplink commands from the Ku Datalink Terminal to the Ku Antenna Assembly, and the transmission of downlink information from the Ku Antenna Assembly to the Ku Datalink Terminal.

This interface is flight critical and mission critical and is designated as a high priority interface.

The Ku Datalink Terminal to Ku Antenna Assembly interface will be defined and specified in the TCS Ku Band Datalink Terminal Interface Design Description, TCS XXX and the TCS Ku Antenna Control Interface Design Description, TCS XXX

4.3.2.1.3.18 IDT to VME Computer Assembly

4.3.2.1.3.19 Ku Datalink Terminal to VME Computer Assembly

4.3.2.1.3.20 VME Computer Assembly to Video Support

4.3.2.1.3.21 TCS Computer to Operator Output

4.3.2.1.3.22 TCS Computer to Operator Input

4.3.2.2 External Interface Characteristics

The TCS will have external interfaces to C4I systems, power, imagery systems, and launch and recovery systems.

4.3.2.2.1 TCS to C4I Interface Characteristics

4.3.2.2.1.1 Automatic Target Hand-off Systems (ATHS)

The TCS shall have an interface with the Automatic Target Hand-off Systems (ATHS) in accordance with document TCS 208, Tactical Control System to Automatic Target Hand-off Systems Interface Design Description (IDD). (SSS304) [SSDD730]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.3.2.2.1.2 Advanced Field Artillery Tactical Data Systems (AFATDS)

The TCS shall have an interface with the Advanced Field Artillery Tactical Data Systems (AFATDS) in accordance with document TCS 200, Tactical Control System to Advanced Field Artillery Tactical Data Systems Interface Design Description (IDD). (SSS295) [SSDD731

The interface is not flight critical but is mission critical and is designated a medium priority interface.

This interface supports the exchange of non-real-time formatted data between the two systems. The formats supported are: USMTF (United States Message Text Format) messages, TACFIRE (Tactical Fire Support) messages, and still digital imagery in the NITF 2.0 (National Imagery Transmission Format, Version 2.0) format.

This interface medium can be a digital local area network (LAN), SINCGARS (Single Channel Ground and Airborne Radio System), Mobile Subscriber Equipment (MSE), or TACFIRE communications.

4.3.2.2.1.3 Army Deep Operations Coordination System (ADOCS)

The TCS shall have an interface with the All Source Analysis System (ASAS) in accordance with document TCS 201, Tactical Control System to All Source Analysis System Interface Design Description (IDD). (SSS296) [SSDD732

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.3.2.2.1.4 All Source Analysis System (ASAS)

The TCS shall have an interface with the All Source Analysis System (ASAS) in accordance with document TCS 201, Tactical Control System to All Source Analysis System Interface Design Description (IDD).(SSS291) [SSDD733]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

This interface supports the exchange of non-real-time formatted data between the two systems. The formats supported are: USMTF (United States Message Text Format) messages, still digital imagery in the NITF 2.0 (National Imagery Transmission Format, Version 2.0) format, TIFF (Aldus/Microsoft Tag Image Format Files) imagery, and Sunraster imagery.

This interface medium can be either a digital local area network, SINCGARS (Single Channel Ground and Airborne Radio System) radios, Mobile Subscriber Equipment (MSE), or TACFIRE communications.

4.3.2.2.1.5 Intelligence Analysis System (IAS)

The TCS shall have an interface with the Intelligence Analysis System (IAS) in accordance with document TCS 206, Tactical Control System to Intelligence Analysis System Interface Design Description (IDD).(SSS303) [SSDD734]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.3.2.2.1.6 Joint Standoff Target Attack Radar System (JSTARS) Ground Station Module/Common Ground Station (GSM/CGS)

The TCS shall have an interface with the Joint Surveillance Target Attack Radar System (JSTARS) Advanced Imagery Common Ground Station (AI CGS) in accordance with document TCS 209, Tactical Control System to Joint Surveillance Target Attack Radar System Advanced Imagery Common Ground Station Interface Design Description (IDD). (SSS292) (SSDD735]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

This interface supports the exchange of non-real-time formatted data and real-time analog video imagery and associated telemetry between the two systems. The formats supported are: USMTF (United States Message Text Format) messages, mission and flight data messages, area of interest messages, TSAR waterfall data, still digital imagery and support data in the NITF 2.0 (National Imagery Transmission Format, Version 2.0) format, and voice via LAN. The real-time analog imagery is NTSC (National Television System Committee) video.

This interface media are a digital local area network for the non-real-time information and a coaxial cable for the NTSC video.

4.3.2.2.1.7 Joint Maritime command Information System (JMCIS)

The TCS shall have an interface with the Joint Maritime Command Information System (JMCIS) in accordance with document TCS 214, Tactical Control System to Joint Maritime Command Information System Interface Design Description (IDD). (SSS293) [SSDD736]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

This interface supports the exchange of non-real-time formatted data and real-time analog video imagery and associated telemetry between the two systems. The non-real-time formats supported are: USMTF (United States Message Text Format) messages, OTH-T GOLD messages, TIFF

(Aldus/Microsoft Tag Image Format Files) imagery, Sunraster imagery, and still digital imagery and support data in the NITF 2.0 (National Imagery Transmission Format, Version 2.0) format.

This interface media are a digital local area network for the non-real-time information and a coaxial cable for the real-time imagery.

4.3.2.2.1.8 Closed Circuit Television (CCTV)

The TCS shall have an interface with Closed Circuit Television (CCTV) Systems in accordance with document TCS 205, Tactical Control System to Closed Circuit Television System Interface Design Description (IDD). (SSS298) [SSDD737

The interface is not flight critical but is mission critical and is designated a medium priority interface.

This interface supports the exchange of real-time NTSC analog video imagery between the two systems.

This interface medium is a coaxial cable.

4.3.2.2.1.9 Advanced Tomahawk Weapons Control Station (ATWCS)

The TCS shall have an interface with Advanced Tomahawk Weapons Control Stations (ATWCS) in accordance with document TCS 203, Tactical Control System to Advanced Tomahawk Weapons Control Station Interface Design Description (IDD). (SSS305) [SSDD738]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.3.2.2.1.10 Joint Deployable Intelligence Support System (JDISS)

The TCS shall have an interface with the Joint Deployable Intelligence Support System (JDISS) in accordance with document TCS 212, Tactical Control System to Joint Deployable Intelligence Support System Interface Design Description (IDD). (SSS301) [SSDD739

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.3.2.2.1.11 Trojan Special Purpose Integrated Remote Intelligence Terminal (SPIRIT) II

The TCS shall have an interface with the Trojan Special Purpose Integrated Remote Intelligence Terminal (SPIRIT) II in accordance with document TCS 213, Tactical Control System to Trojan Special Purpose Integrated Remote Intelligence Terminal (SPIRIT) II Interface Design Description (IDD). (SSS306) [SSDD740]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.3.2.2.1.12 Joint Service Imagery Processing System (JSIPS)

The TCS shall have an interface with the Joint Service Imagery Processing System - Air Force (JSIPS–AF) in accordance with document TCS 211, Tactical Control System to Joint Service Imagery Processing System – Air Force Interface Design Description (IDD). (SSS294) [SSDD741]

The TCS shall have an interface with the Joint Service Imagery Processing System (JSIPS)-Navy in accordance with document TCS 210, Tactical Control System to Joint Service Imagery Processing System – Navy Interface Design Description (IDD). (SSS294) [SSDD742]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

This interface supports the exchange of non-real-time formatted data and real-time analog video imagery and associated telemetry between the two systems. The non-real-time format supported is still digital imagery and support data in the NITF 2.0 (National Imagery Transmission Format, Version 2.0) format. The real-time imagery is NTSC video.

This interface media are a digital local area network for the non-real-time information and a coaxial cable for the real-time video.

4.3.2.2.1.13 JSIPS Tactical Exploitation Group (JSIPS TEG)

The TCS shall have an interface with the Joint Service Imagery Processing System Tactical Exploitation Group (JSIPS TEG) in accordance with document TCS 207, Tactical Control System to Joint Service Imagery Processing System Tactical Exploitation Group Interface Design Description (IDD). (SSS311) [SSDD743]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.3.2.2.1.14 Tactical Exploitation System (TES)

The TCS shall have an interface with the Joint Service Imagery Processing System Tactical Exploitation System (TES) in accordance with document TCS TBD, Tactical Control System to Joint Service Imagery Processing System Tactical Exploitation System Interface Design Description (IDD). (SSS302) [SSDD744]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.3.2.2.1.15 Service Mission Planners

The TCS shall have an interface with the Air Force Mission Support System (AFMSS) in accordance with document TCS 220, Tactical Control System to Air Force Mission Support System Interface Design Description (IDD). (SSS299) [SSDD745]

The TCS shall have an interface with the Army Mission Planning System (AMPS) in accordance with document TCS TBD, Tactical Control System to Army Mission Planning System Interface Design Description (IDD). (SSS299) [SSDD746

The TCS shall have an interface with the Tactical Aircraft Mission Planning System (TAMPS) in accordance with document TCS 219, Tactical Control System to Tactical Aircraft Mission Planning System Interface Design Description (IDD). (SSS299) [SSDD747]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.3.2.2.1.16 Theater Battle Management Core System (TBMCS)

The TCS shall have an interface with the Theater Battle Management Core System (TBMCS) in accordance with document TCS 221, Tactical Control System Theater Battle Management Core System Interface Design Description (IDD). (SSS307) [SSDD748]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.3.2.2.1.17Guardrail Common Sensor Aerial Common Sensor (ACS) Integrated Processing Facility (IPF)

The TCS shall have an interface with the Guardrail Common Sensor Aerial Common Sensor (ACS) Integrated Processing Facility (IPF) in accordance with document TCS 215, Tactical Control System to Guardrail Common Sensor Aerial Common Sensor Integrated Processing Facility Interface Design Description (IDD). (SSS300) [SSDD749]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.3.2.2.1.18Modernized Imagery Exploitation System (MIES)

The TCS shall have an interface with the Modernized Imagery Exploitation System (MIES) in accordance with document TCS 216, Tactical Control System to Modernized Imagery Exploitation System Interface Design Description (IDD). (SSS308) [SSDD750]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.3.2.2.1.19 Enhanced Tactical Radar Correlator (ETRAC)

The TCS shall have an interface with the Enhanced Tactical Radar Correlator (ETRAC) in accordance with document TCS 218, Tactical Control System to Enhanced Tactical Radar Correlator Interface Design Description (IDD). (SSS309) [SSDD751]

The interface is not flight critical but is mission critical and is designated a medium priority

interface.

4.3.2.2.1.20Contingency Airborne Reconnaissance System (CARS)

The TCS shall have an interface with the Contingency Airborne Reconnaissance System (CARS) in accordance with document TCS 217, Tactical Control System to Contingency Airborne Reconnaissance System Interface Design Description (IDD). (SSS297) [SSDD752]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.3.2.2.1.21Common Operational Modeling, Planning, and Simulation System (COMPASS)

The TCS shall have an interface with the Common Operational Modeling, Planning, and Simulation System (COMPASS) in accordance with document TCS 222, Tactical Control System to Common Operational Modeling, Planning, and Simulation System Interface Design Description (IDD). (SSS310) [SSDD753]

The interface is not flight critical but is mission critical and is designated a medium priority interface.

4.3.2.2.2 Power Interface s Characteristics

4.3.2.2.2.1 UPS to External Power Interface Characteristics

The TCS Computer will interface with external power sources.

This interface will consist of the transmission of 110/220 volt 50/60 hertz power signal.

This interface is flight critical and mission crucial and is designated as a high priority interface.

The TCS Power Interfaces will be defined and specified in the TCS to External Power Interface Design Description, TCS XXX.

4.3.2.2.2.2 TCS Computer to UPS Interface Characteristics

The TCS Computer shall have an interface to an uninterruptible power supply. (SSS344) [SSDD754]

This interface will consist of the transmission of power from the UPS to the TCS Computer in order to provide power conditioning and to allow safe and orderly shutdown of the TCS Computer. Safe and orderly shutdown includes consideration of the AV if it is in flight.

This interface is flight critical and mission crucial and is designated as a high priority interface.

The TCS Computer to UPS Interfaces will be defined and specified in the TCS to UPS, TCS XXX Interface Design Descriptions.

4.3.2.2.2.3 Datalink Command Modules to UPS Interface Characteristics

The DCM HWCIs shall have an interface to an uninterruptible power supply. (SSS344) [SSDD755]

This interface will consist of the transmission of power from the UPS to the DCMs in order to allow safe and orderly shutdown of the DCMs. Safe and orderly shutdown includes consideration of the AV if it is in flight.

This interface is flight critical and mission crucial and is designated as a high priority interface.

The TCS UPS Interfaces will be defined and specified in the TCS to UPS, TCS XXX Interface Design Descriptions.

4.3.2.2.3 Image System Interface Characteristics

4.3.2.2.3.1 Image Product Library Interface Characteristics

The TCS will provide an interface to an Image Product Library.

This interface will consist of the transmission of imagery data between the TCS and the Image Product Library.

This interface is not flight critical nor mission crucial and is designated as a low priority interface.

The interface between the TCS and the Image Product Library will be defined in the TCS to Image Product Library Interface Design Description, TCS

4.3.2.2.3.2 Direct Dissemination Element Interface Characteristics

The TCS will provide and interface to a Direct Dissemination Element (DDE).

This interface will consist of the transfer of HAE Imagery data from the DDE to the TCS .

This interface is not flight critical nor mission crucial and is designated as a low priority interface.

This TCS to DDE interface will be defined and specified by the TCS to Direct Dissemination Element Interface Design Description, TCS XXX.

4.3.2.2.4 Launch and Recovery Interfaces

4.3.2.2.4.1 Common Automated Recovery System (CARS)

The TCS will provide an interface to CARS.

This interface will consist of the transmission of AV recovery commands from CARS to TCS and the transmission of AV status from TCS to CARS.

This interface is flight critical and mission crucial and is designated as a high priority interface.

The TCS to CARS interface will be defined and specified in the TCS to CARS Interface Design Description, TCS XXX.

4.3.2.2.4.2 Integrated Beacon Landing System (IBLS)

The TCS will provide an interface to IBLS.

This interface will consist of the transmission of AV recovery commands from IBLS to TCS and the transmission of AV status from TCS to IBLS.

This interface is flight critical and mission crucial and is designated as a high priority interface.

The TCS to IBLS interface will be defined and specified in the TCS to IBLS Interface Design Description, TCS XXX.

5 requirements traceability

6 notes

APPENDIX A TCS-LS (LANDBASED SHELTER-MOUNTED) SYSTEM

A3 TCS-LS System Wide Design Decisions

The primary function for the TCS is to provide command and control of the payload, AV, data link, and other necessary support equipment in order to employ tactical UAVs to conduct reconnaissance, surveillance, target acquisition, and target identification missions. The TCS shall interface with and export/disseminate payload data to supported military units via external (not part of TCS) tactical communications systems, and C4I systems. Communications procedures, formats, and interfaces will be interoperable with selected standard DoD C4I systems, architectures, and protocols.

A3.1 Inputs and Outputs

See Section 3.1

A3.2 System Behavior

See Section 3.2

A3.2.1 System Actions

See Section 3.2.1

A3.2.2 Response Times

A3.2.3 Error Handling

A3.3 Safety, Security, And Privacy

See Section 3.3

A3.4 Design and Construction Choices

The TCS-LS will be installed in HMMWV shelter with power supplied by gas driven generators or commercial power sources providing 110V at 60Hz.

The TCS components shall be capable of operation in environments expected within the land-based shelter

A3.5 Logistics Related Requirements

See Section 3.5

A3.6 TCS Design Documents

See Section 3.6

A4 TCS-LS System Architectural Design

A4.1 System Components

As shown in Figure A4.1-1, the TCS-LS is comprised of the following core elements: two (2) TCS Computer HWCIs, two (2) Video Support HWCIs, two (2) TCS SAR Processor HWCIs, two (2) VCR HWCIs, two (2) Linear Digital Tape Drive HWCIs, and two (2) TCS LAN HWCIs, configuration dependent number and type of Datalink Command Module HWCIs, one(1) TCS Printer HWCI, and two (2) copies of the TCS CSCIs. For TCS-LS applications requiring only level 1 interaction, no Datalink Command Module is required.

The TCS-LS shall also contain the following unique HWCIs: C4I Support Equipment HWCI, TCS Circuit Breaker HWCI, TCS-LS External Connectors Panel HWCI, Workstation Console HWCI, TCS-LS Shelter HWCI, C4I Communication Equipment, Intercom Equipment, and the Uninterruptible Power Supply HWCI.

The TCS-LS C4I Communication Equipment shall include any combination of the following: VHF Radio HWCI, UHF Radio HWCI, HF Radio HWCI, VHF/UHF Radio, Digital Secure Voice Terminal HWCI, KY-68 HWCI, and TBD additional MSE Equipment.

The TCS-LS support equipment shall include the following: up to two External Data Storage HWCIs, Datalink Terminal(s), the CARS HWCI, and the IBLS HWCIThe TCS-LS support equipment may also include a external printer.

Each TCS will support both a LOS datalink and a Ku datalink. The TCS-LS, which includes two TCSs, shall support a minimum of four Datalink Terminals.

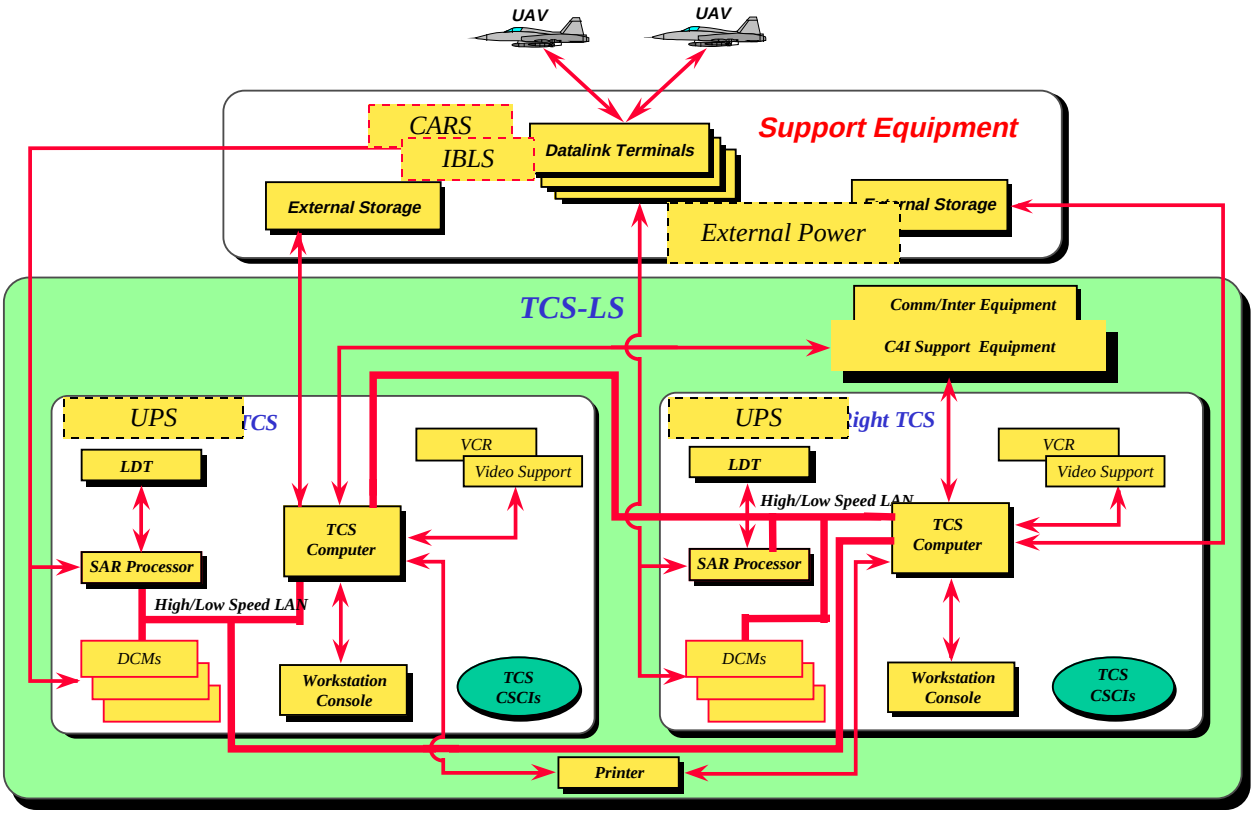

Figure A4.1-1 TCS-LS

A4.1.1 TCS HWCIs

See Section 4.1.1

A4.1.1.1 TCS Computer HWCI

See Section 4.1.1.1

A4.1.1.2 Video Support HWCI

(see Section 4.1.1.2)

A4.1.1.3 TCS SAR Processor HWCI

(See Section 4.1.1.3)

A4.1.1.4 Datalink Terminal HWCIs

(See Section 4.1.1.4)

A4.1.1.4.1 Integrated Datalink Terminal HWCI

(See Section 4.1.1.4.1)

A4.1.1.4.2 Ku Datalink Terminal HWCI

(See Section 4.1.1.4.2)

A4.1.1.5 Datalink Control Module HWCIs

(See Section 4.1.1.5)

A4.1.1.5.1 Predator Datalink Control Module HWCI

(See Section 4.1.1.5.1)

A4.1.1.5.2 Outrider Datalink Control Module HWCI

(See Section 4.1.1.5.2)

A4.1.1.5.3 Pioneer Datalink Control Module HWCI

(See Section 4.1.1.5.3)

A4.1.1.6 VCR HWCI

(See Section 4.1.1.6)

A4.1.1.7 External Storage HWCI

(See Section 4.1.1.7)

A4.1.1.8 TCS Printer HWCI

(See Section 4.1.1.8)

A4.1.1.9 Uninterruptible Power Supply HWCI

(See Section 4.1.1.9)

A4.1.1.10 Intercom Equipment HWCI

(See Section 4.1.1.10)

A4.1.1.11 C4I Support Equipment HWCI

(See Section 4.1.11)

A4.1.1.12 Communication Equipment HWCIs

A4.1.1.12.1 MSE Equipment HWCI

The purpose of the MSE is to provide a corps level and below common-user system which provides secure, long-range communications to subordinate divisions, adjacent units, joint and allied services, and the Defense Information Systems Network (DISN). MSE consists of a network of line-of-sight (LOS) multi-channel radios and interconnected local and long distance switching nodes which provide wide area communications coverage and network access points and facilities to battlefield commanders and staffs. MSE is the backbone of the Corps' and Division's communications systems and provides voice and data communications from the corps rear boundary forward to the division maneuver battalion's main and rear Command Posts (CPs).

The major items of MSE equipment are integrated into six functional areas: Subscriber Terminals, Mobile Subscriber Access, Wire Subscriber Access, Area Coverage, System Control, Packet Network.

The MSE shall send the TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L

A4.1.1.12.2 UHF/VHF Radio HWCI

The VHF/UHF Radio shall send the TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L).

A4.1.1.12.3 KY-68 HWCI

The KY68 will send the TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L).

A4.1.1.12.4 UHF radio(s) HWCI

The UHF Radio shall send the TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L).

A4.1.1.12.5 HF radio(s) HWCI

The HF Radio shall send the TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L).]

A4.1.1.12.6 VHF radio(s) HWCI

The VHF Radio shall send the TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L).

A4.1.1.12.7 Digital Secure Voice Terminal HWCI

The DSVT will send the TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L).

A4.1.1.13 Workstation Console HWCI

See Section 4.1.13

A4.1.1.14 VME Computer Assembly HWCI

See Section 4.1.14

A4.1.1.15 Integrity Beacon Landing System (IBLS) HWCI

See Section 4.1.15

A4.1.1.16 CARS HWCI

See Section 4.1.16

A4.1.1.17 Linear Digital Tape Drive HWCI

See Section 4.1.17

A4.1.1.18 LOS Antenna Assembly HWCI

See Section 4.1.18

A4.1.1.19 Ku Antenna Assembly HWCI

See Section 4.1.19

A4.1.1.20 TCS-LS Circuit Breaker HWCI

The TCS-LS shall provide a circuit breaker panel. The circuit breaker panel shall be designed to provide a safe operating environment for the TCS operator(s), and provide sufficient circuit protection of the TCS equipment .

The TCS-LS Circuit Breaker shall send TCS Core Functionality CSCI the results of its periodic Fault Detection/Location (FD/L) if applicable.

A4.1.1.21 TCS-LS External Connectors Panel HWCI

The TCS shall have an external power panel to receive cables from the power generator . [The external power shall be pre-conditioned by passing it through an Electromagnetic Interference (EMI) filter and a surge protector. The power shall then be routed through the main circuit breaker

The TCS shall have an I/O panel to receive interconnect cables from peripheral equipment [SSDD#]. The external I/O panel interfaces shall include but not be limited to the following peripheral equipment

LOS Datalink Terminal TBD
Ku Band SATCOM Terminal TBD
C4I TBD
Landline Communications TBD
Long Distance Communications TBD

A4.1.1.22 Shelter HWCI

The shelter shall be of military ruggedized and hardened to EMP shielding and easily mounted on a Highly Mobile Multi Wheel Vehicle (HMMWV). It shall not inhibit roll on, roll off of a C130 aircraft. It shall provide workstation space allocation for two soldier/operator workstations. Cable routing and lighting provision shall be provided for future growth and networking. Ground provisions shall be easily implemented for power distribution and operation in arid areas. The shelter shall meet all the lighting and crew equipment storage requirements of MIL-STD-1472. Provisions for climate control (air conditioning and heating), low level IR signature interior lighting, water provisions for length of mission shifts, storage for war fighting equipment, weapons, MOPP IV gear shall be made. Also provisions for positive pressure CBR environmental protection shall be implemented. The shelter shall provide limited storage for spare parts critical to mission operation. It shall provide a workstation space meeting all the requirements for operation by two soldier/operators for the TCS. The shelter shall have roof access suitable for operator access wearing cold region footwear. Time to emplace shall not exceed 30 minutes. The TCS shelter shall be emplaceable on terrain slopes not exceeding 20 degrees. It shall provide shelves necessary for mounting communication and data processing equipment. The shelter shall allocate space for embedded training equipment, location of tape/disc(s) and easy access to manuals for training and maintenance operations. For situations where shelter power will be provided from the HMMWV battery, shelter demand shall not drain the battery power below cranking voltages.

A4.1.2 TCS Computer Software Configuration Items (CSCI)

See Section 4.1.2

A4.1.2.1 All TCS CSCIs

See Section 4.2.1

A4.1.2.1.1 Design Standards

See Section 4.2.1.1

A4.1.2.1.2 Security

See Section 4.2.1.2

A4.1.2.1.3 Reliability

See Section 4.2.1.3

A4.1.2.1.4 Training

See Section 4.2.1.4

A4.1.2.1.5 Warnings

See Section 4.2.1.5

A4.1.2.1.6 HCI

See Section 4.2.1.6

A4.1.2.1.7 System Status

See Section 4.2.1.7

A4.1.2.2 TCS Core Functionality CSCI

See Section 4.1.2.2

A4.1.2.2.1 System Setup

See Section 4.1.2.2.1

A4.1.2.2.2 TCS Main

See Section 4.1.2.2.2

A4.1.2.2.3 AV Control

See Section 4.1.2.2.3

A4.1.2.2.4 AV Flight Monitoring

See Section 4.1.2.2.4

A4.1.2.2.5 Datalink Management and Control

See Section 4.1.2.2.5

A4.1.2.2.6 EO/IR Payload Control

See Section 4.1.2.2.6

A4.1.2.2.7 EO/IR Imagery Viewer

See Section 4.1.2.2.7

A4.1.2.2.8 EO/IR Imagery Data Acquisition

See Section 4.1.2.2.8

A4.1.2.2.9 C4I Messages

See Section 4.1.2.2.9

A4.1.2.2.10 NITF Files

See Section 4.1.2.2.10

A4.1.2.2.11 Targeting

See Section 4.1.2.2.11

A4.1.2.2.12 Collection Tasking and Retasking

See Section 4.1.2.2.12

A4.1.2.2.13 Launch and Recovery

See Section 4.1.2.2.13

A4.1.2.2.14 Training

See Section 4.1.2.2.14

A4.1.2.2.15 Maintenance

See Section 4.1.2.2.15

A4.1.2.3 TCS Mission Planner CSCI

See Section 4.1.2.3

A4.1.2.3.1 Route Planner

See Section 4.1.2.3.1

A4.1.2.3.2 Payload Planner

See Section 4.1.2.3.2

A4.1.2.3.3 Datalink Planner

See Section 4.1.2.3.3

A4.1.2.3.4 Communications Planner

See Section 4.1.2.3.4

A4.1.2.3.5 Plan Monitoring

A4.1.2.4 SAR CSCI

See Section 4.1.2.4

A4.1.2.4.1 SAR Payload Control

See Section 4.1.2.4.1

4.1.2.4.2 SAR Imagery Viewer

See Section 4.1.2.4.2

A4.1.2.4.3 SAR Imagery Data Acquisition

See Section 4.1.2.4.3

A4.1.2.4.4 NITF Files

See Section 4.1.2.4.4

A4.1.2.5 C4I Interfaces CSCI

See Section 4.1.2.5

A4.1.2.6 DII/COE CSCI

See Section 4.1.2.6

A4.1.2.7 Real Time Processes (RTP) CSCI

See Section 4.1.2.7

A4.1.2.7.1 Antenna Control

See Section 4.1.2.7.1

A4.1.2.7.2 AVSI Conversion

See Section 4.1.2.7.2

A4.1.2.7.3 CARS Conversion

See Section 4.1.2.7.3

A4.1.2.7.4 IBLS Conversion

See Section 4.1.2.7.4

A4.1.2.8 TCS Data Server CSCI

See Section 4.1.2.8

A4.1.2.9 User Interface Manager CSCI

See Section 4.1.2.9

A4.2 Concept Of Execution

See Section 4.

A4.2.1 Flow of Execution Control

See Section 4.2.1 for a detail discussion of this section.

During travel to the operational site, or TCS set up, voice channel communication shall be used as the primary means of communication.. While setting up, the TCS shall be in a pre-operation state during which only radio communications may be sent and received.

A4.2.1.1 Normal Operations Mode Execution

The TCS-LS shall allow operators to sub-divide in any manner these activities of execution between all TCSs connected to the Datalink Network, nominally two TCSs, for one to four AVs as illustrated in figure A4.2.1.1-1. The activities associated with normal operations mode are described in Section

4.2.1.1.

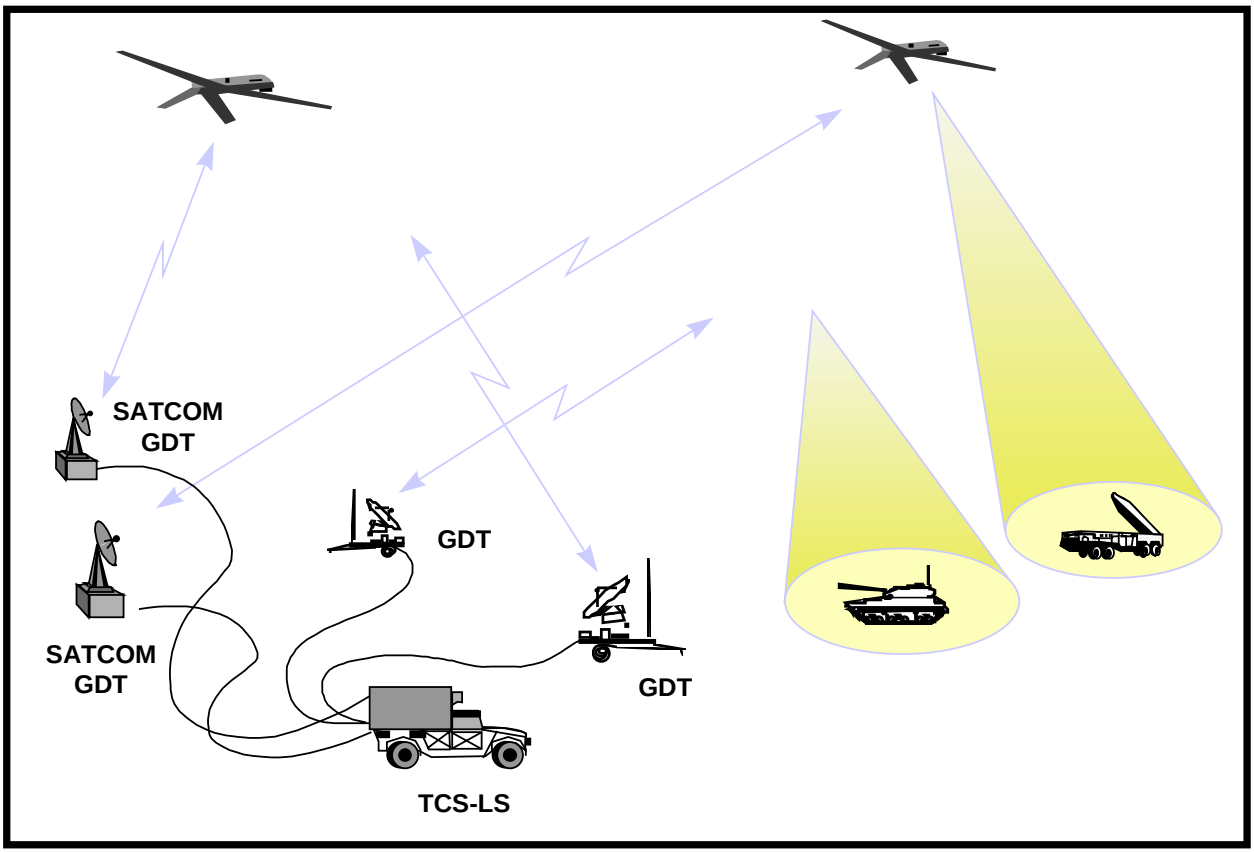

Figure A4.2.1.1-1 Tactical Scenario Illustrating TCS-LS Controlling Four AVs

A4.2.1.1.1 C4I Communication Reception

See Section 4.2.1.1.1

A4.2.1.1.2 C4I Communication Transmission

See Section 4.2.1.1.2

A4.2.1.1.3 Transfer Control of AV

See Section 4.2.1.1.3

A4.2.1.1.4 Receive Control of AV

See Section 4.2.1.1.4

A4.2.1.1.5 Transfer Control of Payload

See Section 4.2.1.1.5

A4.2.1.1.6 Receive Control of Payload

See Section 4.2.1.1.6

A4.2.1.1.7 AV Launch

See Section 4.2.1.1.7

A4.2.1.1.8 AV Recovery

See Section 4.2.1.1.8

A4.2.1.1.9 AV(s) Monitoring

See Section 4.2.1.1.9

A4.2.1.1.10 AV(s) Control

See Section 4.2.1.1.10

A4.2.1.1.11 Payload Monitoring

See Section 4.2.1.1.11

A4.2.1.1.12 Payload Control

See Section 4.2.1.1.12

A4.2.1.1.13 Payload Data Reception, Utilization, and Storage

See Section 4.2.1.1.13

A4.2.1.1.14 Targeting

See Section 4.2.1.1.14

A4.2.1.1.15 Datalink Monitoring

See Section 4.2.1.1.15

A4.2.1.1.16 Datalink Control

See Section 4.2.1.1.16

A4.2.1.1.17 Mission Planning

See Section 4.2.1.1.17

A4.2.1.1.18 VCR Control

See Section 4.2.1.1.18

A4.2.1.1.19 Printer Control

See Section 4.2.1.1.19

A4.2.1.1.20 Voice Input/Output Communication

See Section 4.2.1.1.20

A4.2.1.1.21 TCS to TCS Communication

See Section 4.2.1.1.21

A4.2.1.1.22 Analog Video Input/Output

See Section 4.2.1.1.22

A4.2.1.1.23 External LAN

See Section 4.2.1.1.23

A4.2.1.2 Training Mode Execution

See Section A4.2.1.2

A4.2.1.3 Maintenance Mode Execution

See Section 4.2.1.3

A4.2.2 Configuration Item (CI) Priorities

See Section 4.2.2

A4.2.3 Interrupt Handling

See Section 4.2.3.

A4.2.4 Exception Handling

See Section 4.2.4

A4.3 Interface Design

A4.3.1 TCS Interface Identification

A4.3.1.1 TCS Component Interfaces

See Section 4.3.1.1

A4.3.1.1.1 Software to Software Interfaces

See Section 4.3.1.1.1

A4.3.1.1.2 Software to Hardware Interfaces

See Software to hardware Interfaces in Section 4.3.1.1.2

A4.3.1.1.3 Hardware to Hardware Interfaces

The interfaces listed in this section are those applicable to the TCS-LS, but not included in Section 4.3.1.1.3.

1. TCS Computer to External Interface Panel
2. External Interface Panel to External Printer
3. External Interface Panel to External Storage
4. TCS Computer to Workstation Console
5. Circuit Breaker Panel to External Interface Panel
6. DCMs (specify each tbd) to External Interface Panel
7. External Interface Panel to Datalink Terminals (specify each tbd)
8. External Interface Panel to CARS
9. External Interface Panel to IBLS
10. External Interface Panel to SAR Processor
11. TCS Computer to C4I Support Equipment
12. C4I Support Equipment to KY-68
13. KY-68 to MSE Communication Equipment
14. KY-68 to VHF Radios
15. KY-68 to UHF Radios
16. KY-68 to HF Radios
17. KY-68 to UHF/VHF Radios
18. Digital Secure Voice Terminal to VHF Radios

19. Digital Secure Voice Terminal to UHF Radios
20. Digital Secure Voice Terminal to HF Radios
21. Digital Secure Voice Terminal to UHF/VHF Radios
22. Digital Secure Voice Terminal to MSE Communication Equipment
23. C4I Communication Equipment to External Interface Panel
24. High/Low LANs to External Interface Panel
25. CARS Equipment to External Interface Panel
26. IBLS Equipment to External Interface Panel

A4.3.1.2 TCS External Interfaces

A4.3.1.2.1 C4I Interfaces

A4.3.1.2.2 Power Interfaces

See Section 4.3.1.2.2 for general power interfaces. Below is a list for TCS-LS configuration.

1. Intercom Equipment to Circuit Breaker Panel
2. UHF Radios to Circuit Breaker Panel
3. VHF Radios to Circuit Breaker Panel
4. HF Radios to Circuit Breaker Panel
5. UHF/VHF Radios to Circuit Breaker Panel
6. MSE Equipment to Circuit Breaker Panel
7. KY-68 to Circuit Breaker Panel
8. Digital Secure Voice Terminal to Circuit Breaker Panel
9. External Interface Panel to External Power
10. Environmental Control Equipment to Circuit Breaker Panel
11. External Interface Panel to Antennas
12. Video Support to External Interface Panel
13. SAR Processor to Circuit Breaker Panel
14. Linear Digital Tape Drive to Circuit Breaker Panel
15. Workstation Console to UPS
16. UPS to Circuit Breaker Panel
17. VCR to Circuit Breaker Panel
18. Printer to Circuit Breaker Panel
19. Circuit Breaker Panel to External Interface Panel
20. External Interface Panel to Datalink Terminals

A4.3.1.2.3 Imagery System Interfaces

See Section 4.3.1.2.3.

A4.3.1.2.4 Launch and Recovery Interfaces

See Section 4.3.1.2.4.

A4.3.2 Interface Characteristics

A4.3.2.1 TCS Component Interface Characteristics

A4.3.2.1.1 Software to Software Interface Characteristics

See Section 4.3.2.1.1

A4.3.2.1.2 Software to Hardware Interfaces Characteristics

A4.3.2.1.2.1 DII/COE to Internal Printer

A4.3.2.1.2.2 DII-COE to External Printer

A4.3.2.1.2.3 DII-COE to External Storage

A4.3.2.1.2.4 Operating System to TCS Computer

A4.3.2.1.2.5 C4I Interfaces to C4I Support Equipment

A4.3.2.1.2.6 TCS Core Functionality to Video Support

A4.3.2.1.2.7 TCS Core Functionality to VCR

A4.3.2.1.2.8 SAR to SAR Processor

A4.3.2.1.2.9 TCS Data Server to DCMs (AV Standard Interface)

A4.3.2.1.2.10 TCS RTP to CARS

A4.3.2.1.2.11 TCS RTP to IBLS

A4.3.2.1.2.12 RTP to VME Computer Assembly

A4.3.2.1.3 Hardware to Hardware Interfaces Characteristics

A4.3.2.1.3.1 TCS Computer to C4I Support Equipment

The TCS Computer HWCI shall have a connection to the C4I Support Equipment to allow for the

transmission of information to standard DoD tactical radios..

The TCS Computer HWCI shall have a connection to the C4I Support Equipment to allow for the transmission of information to external mission tasking systems.

A4.3.2.1.3.2 TCS Computer to Printer

A4.3.2.1.3.3 TCS Computer to Video Support

A4.3.2.1.3.4 TCS Computer to VCR

A4.3.2.1.3.5 Video Support to VCR

A4.3.2.1.3.6 TCS Computer to SAR Processor

A4.3.2.1.3.7 TCS Computer to VME Computer Assembly Interface

A4.3.2.1.3.8 VME Computer Assembly to Datalink Command Modules

A4.3.2.1.3.9 TCS Computer to Co-located TCS Computer(s)

A4.3.2.1.3.10 DCMs to IDT

A4.3.2.1.3.11 IDT to LOS Antenna Assembly

A4.3.2.1.3.12 SAR Processor to Ku Antenna Assembly

A4.3.2.1.3.13 VME Computer Assembly to LOS Antenna Assembly

A4.3.2.1.3.14 DCM to Ku Antenna Assembly

A4.3.2.1.3.15 SAR Processor to Linear Digital Tape Drive

A4.3.2.1.3.16 TCS Computer to External Data Storage

A4.3.2.1.3.17 Ku Datalink Terminal to Ku Antenna Assembly

A4.3.2.1.3.18 IDT to VME Computer Assembly

A4.3.2.1.3.19 Ku Datalink Terminal to VME Computer Assembly

A4.3.2.1.3.20 VME Computer Assembly to Video Support

A4.3.2.1.3.21 TCS Computer to Operator Output

A4.3.2.1.3.22 TCS Computer to Operator Input

A4.3.2.1.3.23 TCS Computer to External Interface Panel

A physical interface shall exist between the TCS Computer HWCI and the External Interface Panel HWCI.

A4.3.2.1.3.24 External Interface Panel to External Printer

A physical interface shall exist between the External Interface Panel HWCI and the External Printer HWCI.

A4.3.2.1.3.25 External Interface Panel to External Storage

The External Interface Panel shall have a physical interface to External Storage HWCIs.

A4.3.2.1.3.26 TCS Computer to Workstation Console

A4.3.2.1.3.27 Circuit Breaker Panel to External Interface Panel

A4.3.2.1.3.28 DCMs to External Interface Panel

The DCM HWCIs and External Interface Panel shall be connected by a physical interface in order to send and receive all required information to and from the Air Vehicle.

A4.3.2.1.3.29 External Interface Panel to Datalink Terminals

The External Interface Panel HWCI and the Datalink Terminal(s) shall be connected by a physical interface in order to send and receive all required information to and from the Air Vehicle. [

A4.3.2.1.3.30 External Interface Panel to CARS

A4.3.2.1.3.31 External Interface Panel to IBLS

A4.3.2.1.3.32 External Interface Panel to SAR Processor

A4.3.2.1.3.33 C4I Support Equipment to KY-68

The TCS C4I Support shall have a connection to the KY 68 to allow for the transmission of information to standard DoD tactical radios.

The TCS C4I Support shall have a connection to the KY 68 to allow for the transmission of information to external mission tasking systems.

The TCS C4I Support shall have a connection to the KY 68 to allow for the transmission to the

following C4I systems:

1. Radio data burst connectivity to Automatic Target Hand-off Systems (ATHS)
2. Advanced Field Artillery Tactical Data Systems (AFATDS)]
3. Army Deep Operations Coordination System (ADOCS)
4. Wire connectivity to the All Source Analysis System (ASAS)
5. The Intelligence Analysis System (IAS)
6. The Joint Standoff Target Attack Radar System (JSTARS) Ground Station Module/Common Ground Station (GSM/CGS)
7. The Joint Maritime command Information System (JMCIS)
8. Closed Circuit Television (CCTV)
9. Advanced Tomahawk Weapons Control Station (ATWCS)
10. Joint Deployable Intelligence Support System (JDISS)
11. Trojan Special Purpose Integrated Remote Intelligence Terminal (SPIRIT) II
12. Joint Service Imagery Processing System (JSIPS)
13. JSIPS Tactical Exploitation Group (JSIPS TEG)
14. Tactical Exploitation System (TES)
15. Service Mission Planners
16. The Theater Battle Management Core System (TBMCS)
17. The Guardrail Common Sensor Aerial Common Sensor (ACS) Integrated Processing Facility (IPF)
18. Modernized Imagery Exploitation System (MIES)
19. Enhanced Tactical Radar Correlator (ETRAC)
20. Contingency Airborne Reconnaissance System (CARS)
21. Common Operational Modeling, Planning, and Simulation System (COMPASS

A4.3.2.1.3.34 KY-68 to MSE Communication Equipment

The KY-68 HWCI shall have a connection to the MSE Communication Equipment HWCI to allow for the transmission of information to standard DoD tactical radios..

The KY-68 HWCI shall have a connection to the MSE Communication Equipment HWCI to allow for the transmission of information to external mission tasking systems.]

A4.3.2.1.3.35 KY-68 to VHF Radios

The KY-68 HWCI shall have a connection to the VHF Radios HWCI to allow for the transmission of information to standard DoD tactical radios..

The KY-68 HWCI shall have a connection to the VHF Radios HWCI to allow for the transmission of information to external mission tasking systems.

A4.3.2.1.3.36 KY-68 to UHF Radios

The KY-68 HWCI shall have a connection to the UHF Radios HWCI to allow for the transmission of information to standard DoD tactical radios..

The KY-68 HWCI shall have a connection to the UHF Radios HWCI to allow for the transmission of information to external mission tasking systems.

A4.3.2.1.3.37 KY-68 to HF Radios

The KY-68 HWCI shall have a connection to the HF Radios HWCI to allow for the transmission of information to standard DoD tactical radios..

The KY-68 HWCI shall have a connection to the HF Radios HWCI to allow for the transmission of information to external mission tasking systems.

A4.3.2.1.3.38 KY-68 to UHF/VHF Radios

The KY-68 HWCI shall have a connection to the UHF/VHF Radios HWCI to allow for the transmission of information to standard DoD tactical radios..

The KY-68 HWCI shall have a connection to the UHF/VHF Radios HWCI to allow for the transmission of information to external mission tasking systems.

A4.3.2.1.3.39 Digital Secure Voice Terminal to VHF Radios

The Digital Secure Voice Terminal HWCI shall have a connection to the VHF Radio HWCI to allow for the transmission of information to standard DoD tactical radios..

The Digital Secure Voice Terminal HWCI shall have a connection to the VHF Radio HWCI to allow for the transmission of information to external mission tasking systems.

A4.3.2.1.3.40 Digital Secure Voice Terminal to UHF Radios

The Digital Secure Voice Terminal HWCI shall have a connection to the UHF Radio HWCI to allow for the transmission of information to standard DoD tactical radios..

The Digital Secure Voice Terminal HWCI shall have a connection to the UHF Radio HWCI to allow for the transmission of information to external mission tasking systems.

A4.3.2.1.3.41 Digital Secure Voice Terminal to HF Radios

The Digital Secure Voice Terminal HWCI shall have a connection to the HF Radio HWCI to allow for the transmission of information to standard DoD tactical radios..

The Digital Secure Voice Terminal HWCI shall have a connection to the HF Radio HWCI to allow for the transmission of information to external mission tasking systems.

A4.3.2.1.3.42 Digital Secure Voice Terminal to UHF/VHF Radios

The Digital Secure Voice Terminal HWCI shall have a connection to the UHF/VHF Radio HWCI to allow for the transmission of information to standard DoD tactical radios..

The Digital Secure Voice Terminal HWCI shall have a connection to the UHF/VHF Radio HWCI to allow for the transmission of information to external mission tasking systems.

A4.3.2.1.3.43 Digital Secure Voice Terminal to MSE Communication Equipment

The Digital Secure Voice Terminal HWCI shall have a connection to the MSE Communication Equipment HWCI to allow for the transmission of information to MSE equipment..

The Digital Secure Voice Terminal HWCI shall have a connection to the MSE Communication Equipment HWCI to allow for the transmission of information to external mission tasking systems.

A4.3.2.1.3.44 C4I Communication Equipment to External Interface Panel

The C4I Communication Equipment HWCI shall have a connection to the External Interface Panel HWCI to allow for the transmission of information to standard DoD tactical radios..

The C4I Communication Equipment HWCI shall have a connection to the External Interface Panel HWCI to allow for the transmission of information to external mission tasking systems.

A4.3.2.1.3.45 High/Low LANs to External Interface Panel

The High/Low LAN HWCI shall provide the system functionality to connect to the External Interface Panel in order to access external systems via a local area network.

A4.3.2.1.3.46 CARS Equipment to External Interface Panel

The CARS recovery system shall connect to the External Interface Panel in order to send and receive recovery system information to the TCS via the High/Low LAN.

A4.3.2.1.3.47 IBLS Equipment to External Interface Panel

The IBLS launch and recovery system shall connect to the External Interface Panel in order to send and receive recovery system information to the TCS via the High/Low LAN.

A4.3.2.2 External Interface Characteristics

A4.3.2.2.1 TCS to C4I Interface Characteristics

A4.3.2.2.1.1 Automatic Target Hand-off Systems (ATHS)

A4.3.2.2.2 Power Interfaces Characteristics

A4.3.2.2.2.1 UPS to External Power Interface Characteristics

A4.3.2.2.2.2 TCS Computer to UPS Interface Characteristics

A4.3.2.2.2.3 Datalink Command Modules to UPS Interface Characteristics

A4.3.2.2.2.4 Intercom Equipment to Circuit Breaker Panel

The Intercom Equipment shall physically connect to the Circuit Breaker Panel.

A4.3.2.2.2.5 UHF Radios to Circuit Breaker Panel

The UHF Radios shall physically connect to the Circuit Breaker Panel.

A4.3.2.2.2.6 VHF Radios to Circuit Breaker Panel

The VHF Radios shall physically connect to the Circuit Breaker Panel.

A4.3.2.2.2.7 HF Radios to Circuit Breaker Panel

The HF Radios shall physically connect to the Circuit Breaker Panel.

A4.3.2.2.2.8 UHF/VHF Radios to Circuit Breaker Panel

The UHF/VHF Radios shall physically connect to the Circuit Breaker Panel.

A4.3.2.2.2.9 MSE Equipment to Circuit Breaker Panel

The MSE Equipment shall physically connect to the Circuit Breaker Panel.

A4.3.2.2.2.10 KY-68 to Circuit Breaker Panel

The KY-68 shall physically connect to the Circuit Breaker Panel.

A4.3.2.2.2.11 Digital Secure Voice Terminal to Circuit Breaker Panel

The Digital Secure Voice Terminal shall physically connect to the Circuit Breaker Panel.

A4.3.2.2.2.12 External Interface Panel to External Power

The External Interface Panel shall physically connect to a standard power supply.

A4.3.2.2.2.13 Environmental Control Equipment to Circuit Breaker Panel

The Environmental Control Equipment shall physically connect to the Circuit Breaker Panel.

A4.3.2.2.2.14 External Interface Panel to Antennas

A4.3.2.2.2.15 Video Support to External Interface Panel

The Video Support Equipment shall physically connect to the Circuit Breaker Panel.

A4.3.2.2.2.16 SAR Processor to Circuit Breaker Panel

The SAR Processor shall physically connect to the Circuit Breaker Panel.

A4.3.2.2.2.17 Linear Digital Tape Drive to Circuit Breaker Panel

The Linear Digital Tape Drive shall physically connect to the Circuit Breaker Panel.

A4.3.2.2.2.18 Workstation Console to UPS

The Workstation Console HWCI shall have an interface to an uninterruptible power supply.

A4.3.2.2.2.19 UPS to Circuit Breaker Panel

The UPS shall physically connect to the Circuit Breaker Panel.

A4.3.2.2.2.20 VCR to Circuit Breaker Panel

The VCR shall physically connect to the Circuit Breaker Panel.

A4.3.2.2.2.21 Printer to Circuit Breaker Panel

The Internal Printer shall physically connect to the Circuit Breaker Panel

A4.3.2.2.2.22 Circuit Breaker Panel to External Interface Panel

The Circuit Breaker Panel shall physically connect to the External Interface Panel.

A4.3.2.2.2.23 External Interface Panel to Datalink Terminals

The External Interface Panel shall physically connect to all Datalink Terminals operating with the TCS-LS.

A4.3.2.2.2.24 External Interface Panel to Power Supply

A4.3.2.2.3 Image System Interface Characteristics

A4.3.2.2.4 Launch and Recovery Interface Characteristics

A4.3.2.2.4.1 Common Automated Recovery System (CARS)

A4.3.2.2.4.2 Integrated Beacon Landing System (IBLS)

A5 requirements traceability

A6 notes

APPENDIX B TCS-SB (SHIPBOARD) SYSTEM

B3 TCS-SB System Wide Design Decisions

The primary function for the TCS is to provide command and control of the payload, AV, data link, and other necessary support equipment in order to employ tactical UAVs to conduct reconnaissance, surveillance, target acquisition, and target identification missions. The TCS shall interface with and export/disseminate payload data to supported military units via external (not part of TCS) tactical communications systems, and C4I systems. Communications procedures, formats, and interfaces will be interoperable with selected standard DoD C4I systems, architectures, and protocols.

B3.1 Inputs and Outputs

See Section 3.1.

B3.2 System behavior

See Section 3.2.

B3.3 Safety, Security, and Privacy

See Section 3.3

B3.4 Design and Construction Choices

The TCS-SB will be installed on-board Navy Ships and Boats with power supplied by internal ship's power providing 110V at 60Hz.

The TCS software will reside on the Tactical Advanced Computer (TAC) series of computers utilizing the HP-Unix operating system.

The TCS components shall be capable of operation in environments expected within the shipboard environment.

B3.5 Logistics Related Requirements

See Section 3.5.

B3.6 TCS Design Documents

See Section 3.6

B4 TCS-SB System Architectural Design

B4.1 System Components

As shown in Figure B4.1-1, the TCS-SB is comprised of the following elements: two (2) TCS Computer HWCIs, two (2) Video Support HWCIs, Two (2) TCS SAR Processor HWCIs, two (2) VCR HWCIs, the required Datalink Terminal HWCIs , and two (2) copies of the TCS CSCIs. The TCS-SB also contains the following unique equipment: TCS Printer HWCI, MSE HWCI, C4I Communication Equipment HWCI, the Uninterruptible Power Supply HWCI, two (2) External Data Storage HWCIs, the CARS HWCI, and the IBLS HWCI. The TCS shall support a maximum of four Datalink Terminals (DTs). The Datalink Terminals shall consist of a mixture of one or more of the following units: a Predator Ground Data Terminal (PGDT), Outrider Ground Data Terminal (OGDT), SATCOM Ground Data Terminal, Pioneer Ground Data Terminal (PiGDT). For TCS-SB applications requiring only level 1 interaction, no DT is required.

(Make SB diagram and associated text reflect a single TCS configuration with respect to HWCI/CSCI)

Individual ship configurations may consist of multiple TCSs.

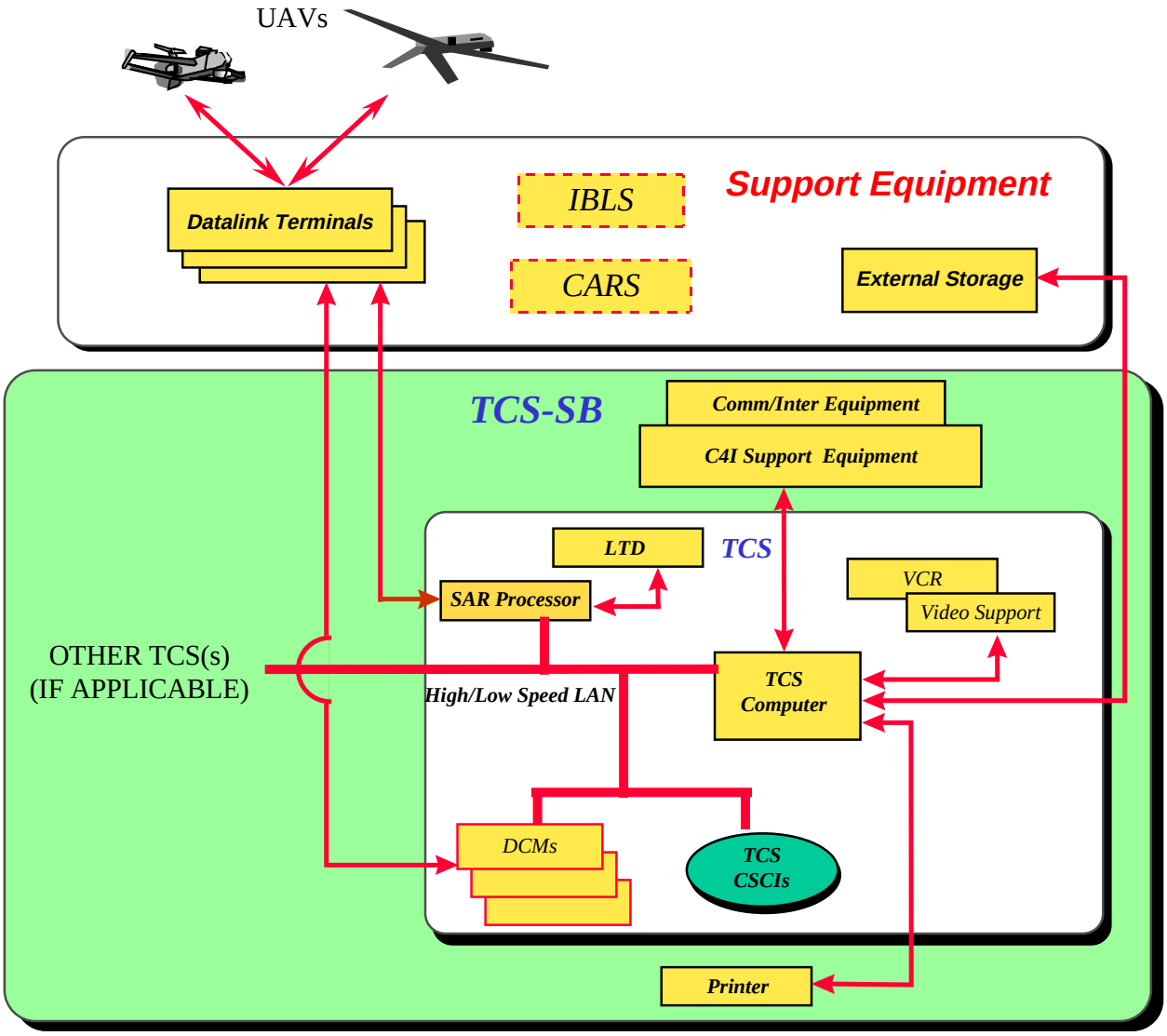

Figure B4.1-1 TCS-SB Configuration

B4.1.1 TCS Hardware Configuration Items

B4.1.1.1 TCS Computer HWCI

See Section 4.1.1.1.

B4.1.1.2 Video Support HWCI

See Section 4.1.1.2.

B4.1.1.3 TCS SAR Processor HWCI

See Section 4.1.1.3.

B4.1.1.4 Datalink Terminal HWCIs.

See Section 4.1.1.4.

B4.1.1.4.1 Integrated Datalink Terminal HWCI

See Section 4.1.1.4.1.

B4.1.1.4.2 Ku Datalink Terminal HWCI

See Section 4.1.1.4.2.

B4.1.1.5 Datalink Control Module HWCIs

See Section 4.1.1.5.

B4.1.1.5.1 Predator Datalink Control Module HWCI

See Section 4.1.1.5.1.

B4.1.1.5.2 Outrider Datalink Control Module HWCI

See Section 4.1.1.5.2.

B4.1.1.5.3 Pioneer Datalink Control Module HWCI

See Section 4.1.1.5.3.

B4.1.1.6 VCR HWCI

See Section 4.1.1.6.

B4.1.1.7 External Storage HWCI.

See Section 4.1.1.7.

B4.1.1.8 TCS Printer HWCI.

See Section 4.1.1.8.

B4.1.1.9 Uninterruptible Power Supply HWCI.

See Section 4.1.1.9.

B4.1.1.10 Intercom Equipment HWCI

See Section 4.1.1.10.

The TCS shall utilize internal shipboard communication systems that allows the operator(s) of the TCS to verbally communicate with each other.

B4.1.1.11 C4I Support Equipment HWCI

See Section 4.1.1.11.

B4.1.1.12 Communication Equipment HWCI

See Section 4.1.1.2.

Shipboard Communications, instead of TCS HWCI.

B4.1.1.13 Operator Output HWCI

See Section 4.1.1.13.

B4.1.1.14 Operator Input HWCI

See Section 4.1.1.14.

B4.1.1.15 VME Computer Assembly HWCI

See Section 4.1.1.15.

B4.1.1.16 Integrity Beacon Landing System (IBLS) HWCI

See Section 4.1.1.16.

B4.1.1.17 CARS HWCI

See Section 4.1.1.17.

B4.1.1.18 Linear Digital Tape Drive HWCI

See Section 4.1.1.18.

B4.1.1.19 LOS Antenna Assembly HWCI

See Section 4.1.1.19

B4.1.1.20 Ku Antenna Assembly HWCI

See Section 4.1.1.20.

B4.1.2 TCS Computer Software Configuration Items (CSCIs)

See Section 4.1.2

B4.1.2.1 All TCS CSCIs

See Section 4.1.2.1.

B4.1.2.1.1 Design Standards

See Section 4.1.2.1.1

B4.1.2.1.2 Security

See Section 4.1.2.1.2

B4.1.2.1.3 Reliability

See Section 4.1.2.1.3

B4.1.2.1.4 Training

See Section 4.1.2.1.4

B4.1.2.1.5 Warnings

See Section 4.1.2.1.5

B4.1.2.1.6 HCI

See Section 4.1.2.1.6

B4.1.2.1.7 System Status

See Section 4.1.2.1.7

B4.1.2.2 TCS Core Functionality CSCI

See Section 4.1.2.2.

B4.1.2.2.1 System Setup

See Section 4.1.2.2.1

B4.1.2.2.2 TCS Main

See Section 4.1.2.2.2

B4.1.2.2.3 AV Control

See Section 4.1.2.2.3

B4.1.2.2.4 AV Flight Monitoring

See Section 4.1.2.2.4

B4.1.2.2.5 Datalink Management and Control

See Section 4.1.2.2.5

For shipboard operations, the TCS Core Functionality CSCI shall provide the capability to control automatic switching to a second LOS antenna, if a second antenna is available, when the currently active antenna is masked by shipboard obstructions.

B4.1.2.2.6 EO/IR Payload Control

See Section 4.1.2.2.6

B4.1.2.2.7 EO/IR Imagery Viewer

See Section 4.1.2.2.7

B4.1.2.2.8 EO/IR Imagery Data Acquisition

See Section 4.1.2.2.8

B4.1.2.2.9 C4I Messages

See Section 4.1.2.2.9

B4.1.2.2.10 NITF Files

See Section 4.1.2.2.10

B4.1.2.2.11 Targeting

See Section 4.1.2.2.11

B4.1.2.2.12 Collection Tasking and Retasking

See Section 4.1.2.2.12

B4.1.2.2.13 Launch and Recovery

See Section 4.1.2.2.13

B4.1.2.2.14 Training

See Section 4.1.2.2.14

B4.1.2.2.15 Maintenance

See Section 4.1.2.2.15

B4.1.2.3 TCS Mission Planner CSCI

See Section 4.1.2.3.

B4.1.2.3.1 Route Planner

See Section 4.1.2.3.1

B4.1.2.3.2 Payload Planner

See Section 4.1.2.3.2

B4.1.2.3.3 Datalink Planner

See Section 4.1.2.3.3

B4.1.2.3.4 Communications Planner

See Section 4.1.2.3.4

B4.1.2.3.5 Plan Monitoring

See Section 4.1.2.3.5

B4.1.2.4 SAR CSCI

See Section 4.1.2.4.

B4.1.2.4.1 SAR Payload Control

See Section 4.1.2.4.1.

B4.1.2.4.2 SAR Imagery Viewer

See Section 4.1.2.4.2.

B4.1.2.4.3 SAR Imagery Data Acquisition

See Section 4.1.2.4.3.

B4.1.2.4.4 NITF Files

See Section 4.1.2.4.4.

B4.1.2.5 C4I Interfaces CSCI.

See Section 4.1.2.5.

B4.1.2.6 DII/COE CSCI

See Section 4.1.2.6.

B4.1.2.7 Real Time Processes (RTP) CSCI

See Section 4.1.2.7.

B4.1.2.7.1 Antenna Control

See Section 4.1.2.7.1.

B4.1.2.7.2 AVSI Conversion

See Section 4.1.2.7.2.

B4.1.2.7.3 CARS Conversion

See Section 4.1.2.7.3.

B4.1.2.7.4 IBLS Conversion

See Section 4.1.2.7.4.

B4.1.2.8 TCS Data Server CSCI

See Section 4.1.2.8.

B4.1.2.9 User Interface Manager CSCI

See Section 4.1.2.9.

B4.2 Concept of Execution

See Section 4.2.

B4.2.1 Flow of Execution Control

See Section 4.2.1.

B4.2.1.1 Normal Operations Mode Execution

See Section 4.2.1.1.

B4.2.1.1.1 C4I Communication Reception

See Section 4.2.1.1.1.

B4.2.1.1.2 C4I Communication Transmission

See Section 4.2.1.1.2.

B4.2.1.1.3 Transfer Control of an AV

See Section 4.2.1.1.3.

B4.2.1.1.4 Receive Control of AV

See Section 4.2.1.1.4.

B4.2.1.1.5 Transfer Control of Payload

See Section 4.2.1.1.5.

B4.2.1.1.6 Receive Control of Payload

See Section 4.2.1.1.6.

B4.2.1.1.7 AV Launch

See Section 4.2.1.1.7.

B4.2.1.1.8 AV Recovery

See Section 4.2.1.1.8.

B4.2.1.1.9 AV(s) Monitoring

See Section 4.2.1.1.9.

B4.2.1.1.10 AV(s) Control

See Section 4.2.1.1.10.

B4.2.1.1.11 Payload Monitoring

See Section 4.2.1.1.11.

B4.2.1.1.12 Payload Control

See Section 4.2.1.1.12.

B4.2.1.1.13 Payload Data Reception, Utilization, and Storage

See Section 4.2.1.1.13.

B4.2.1.1.14 Targeting

See Section 4.2.1.1.14.

B4.2.1.1.15 Datalink Monitoring

See Section 4.2.1.1.15.

B4.2.1.1.16 Datalink Control

See Section 4.2.1.1.16.

B4.2.1.1.17 Mission Planning

See Section 4.2.1.1.17.

B4.2.1.1.18 VCR Control

See Section 4.2.1.1.18.

B4.2.1.1.19 Printer Control

See Section 4.2.1.1.19.

B4.2.1.1.20 Voice Input/Output Communication

See Section 4.2.1.1.20.

B4.2.1.1.21 TCS to TCS Communication

See Section 4.2.1.1.21.

B4.2.1.1.22 Analog Video Input/Output

See Section 4.2.1.1.22.

B4.2.1.1.23 External LAN

See Section 4.2.1.1.23.

B4.2.1.2 Training Mode Execution

See Section 4.2.1.2

B4.2.1.3 Maintenance Mode Execution

See Section 4.2.1.3

B4.2.2 Configuration Item (CI) Priorities

See Section 4.2.2.

B4.2.3 Interrupt Handling

See Section 4.2.3.

B4.2.4 Exception Handling

See Section 4.2.4.

B4.3 Interface Design

B4.3.1 TCS Interface Identification

See Section 4.3.1.

The following interfaces are defined for the TCS-SB configuration:

B4.3.1.1 TCS Component Interfaces

See Section 4.3.1.1.

B4.3.1.1.1 Software to Software Interfaces

See Section 4.3.1.1.1.

B4.3.1.1.2 Software to Hardware Interfaces

See Section 4.3.1.1.2.

B4.3.1.1.3 Hardware to Hardware Interfaces

See Section 4.3.1.1.3

B4.3.1.2 TCS External Interfaces

See Section 4.3.1.2.

B4.3.1.2.1 C4I Interfaces

See Section 4.3.1.2.1

B4.3.1.2.2 Power Interfaces

See Section 4.3.1.2.2.

B4.3.1.2.3 Imagery System Interfaces

See Section 4.3.1.2.3.

B4.3.1.2.4 Launch and Recovery Interfaces

See Section 4.3.1.2.4.

B4.3.2 Interface Characteristics

See Section 4.3.2.

B4.3.2.1 TCS Component Interface Characteristics

See Section 4.3.2.1.

B4.3.2.1.1 Software to Software Interfaces

See Section 4.3.2.1.1.

B4.3.2.1.2 Software to Hardware Interfaces

See Section 4.3.2.1.2.

B4.3.2.1.2.1 DII/COE to Internal Printer

See Section 4.3.2.1.2.1.

B4.3.2.1.2.2 DII/COE to External Printer

See Section 4.3.2.1.2.2.

B4.3.2.1.2.3 DII/COE to External Storage

See Section 4.3.2.1.2.3.

B4.3.2.1.2.4 Operating System to TCS Computer

See Section 4.3.2.1.2.4.

B4.3.2.1.2.5 C4I Interfaces to C4I Support Equipment

See Section 4.3.2.1.2.5.

B4.3.2.1.2.6 TCS Core Functionality to Video Support

See Section 4.3.2.1.2.6.

B4.3.2.1.2.7 TCS Core Functionality to VCR

See Section 4.3.2.1.2.7.

B4.3.2.1.2.8 SAR to SAR Processor

See Section 4.3.2.1.2.8.

B4.3.2.1.2.9 TCS Data Server to DCMs (AV Standard Interface)

See Section 4.3.2.1.2.9.

B4.3.2.1.2.10 TCS RTP to CARS

See Section 4.3.2.1.2.10.

B4.3.2.1.2.11 TCS RTP to IBLS

See Section 4.3.2.1.2.11.

B4.3.2.1.2.12 RTP to VME Computer Assembly

See Section 4.3.2.1.2.12.

B4.3.2.1.3 Hardware to Hardware Interface Characteristics

See Section 4.3.2.1.3.

B4.3.2.1.3.1 TCS Computer to C4I Support Equipment

See Section 4.3.2.1.3.1.

B4.3.2.1.3.2 TCS Computer to Printer

See Section 4.3.2.1.3.2.

B4.3.2.1.3.3 TCS Computer to Video Support

See Section 4.3.2.1.3.3.

B4.3.2.1.3.4 TCS Computer to VCR

See Section 4.3.2.1.3.4.

B4.3.2.1.3.5 Video Support to VCR

See Section 4.3.2.1.3.5.

B4.3.2.1.3.6 TCS Computer to SAR Processor

See Section 4.3.2.1.3.6.

B4.3.2.1.3.7 TCS Computer to VME Computer Assembly Interface

See Section 4.3.2.1.3.7.

B4.3.2.1.3.8 VME Computer Assembly to Datalink Command Modules

See Section 4.3.2.1.3.8.

B4.3.2.1.3.9 TCS Computer to Co-located TCS Computer(s)

See Section 4.3.2.1.3.9.

B4.3.2.1.3.10 DCMs to IDT

See Section 4.3.2.1.3.10.

B4.3.2.1.3.11 IDT to LOS Antenna Assembly

See Section 4.3.2.1.3.11.

B4.3.2.1.3.12 SAR Processor to Ku Antenna Assembly

See Section 4.3.2.1.3.12.

B4.3.2.1.3.13 VME Computer Assembly to LOS Antenna Assembly

See Section 4.3.2.1.3.13.

B4.3.2.1.3.14 DCM to Ku Antenna Assembly

See Section 4.3.2.1.3.14.

B4.3.2.1.3.15 SAR Processor to Linear Digital Tape Drive

See Section 4.3.2.1.3.15.

B4.3.2.1.3.16 TCS Computer to External Data Storage

See Section 4.3.2.1.3.16.

B4.3.2.1.3.17 Ku Datalink Terminal to Ku Antenna Assembly

See Section 4.3.2.1.3.17.

B4.3.2.1.3.18 IDT to VME Computer Assembly

See Section 4.3.2.1.3.18.

B4.3.2.1.3.19 Ku Datalink Terminal to VME Computer Assembly

See Section 4.3.2.1.3.19.

B4.3.2.1.3.20 VME Computer Assembly to Video Support

See Section 4.3.2.1.3.20.

B4.3.2.1.3.21 TCS Computer to Operator Output

See Section 4.3.2.1.3.21.

B4.3.2.1.3.22 TCS Computer to Operator Input

See Section 4.3.2.1.3.22.

B4.3.2.2 External Interface Characteristics

See Section 4.3.2.2.

B4.3.2.2.1 TCS to C4I Interface Characteristics

See Section 4.3.2.2.1.

B4.3.2.2.1.1 Automatic Target Hand-off Systems (ATHS)

See Section 4.3.2.2.1.1.

B4.3.2.2.1.2 Advanced Field Artillery Tactical Data Systems (AFATDS)

See Section 4.3.2.2.1.2.

B4.3.2.2.1.3 Army Deep Operations Coordination System (ADOCS)

See Section 4.3.2.2.1.3.

B4.3.2.2.1.4 All Source Analysis System (ASAS)

See Section 4.3.2.2.1.4.

B4.3.2.2.1.5 Intelligence Analysis System (IAS)

See Section 4.3.2.2.1.5.

B4.3.2.2.1.6 Joint Standoff Target Attack Radar System (JSTARS) Ground Station Module/Common Ground Station (GSM/CGS)

See Section 4.3.2.2.1.6.

B4.3.2.2.1.7 Joint Maritime command Information System (JMCIS)

See Section 4.3.2.2.1.7.

B4.3.2.2.1.8 Closed Circuit Television (CCTV)

See Section 4.3.2.2.1.8.

B4.3.2.2.1.9 Advanced Tomahawk Weapons Control Station (ATWCS)

See Section 4.3.2.2.1.9.

B4.3.2.2.1.10 Joint Deployable Intelligence Support System (JDISS)

See Section 4.3.2.2.1.11.

B4.3.2.2.1.11 Trojan Special Purpose Integrated Remote Intelligence Terminal (SPIRIT) II

See Section 4.3.2.2.1.12.

B4.3.2.2.1.12 Joint Service Imagery Processing System (JSIPS)

See Section 4.3.2.2.1.12.

B4.3.2.2.1.13 JSIPS Tactical Exploitation Group (JSIPS TEG)

See Section 4.3.2.2.1.13.

B4.3.2.2.1.14 Tactical Exploitation System (TES)

See Section 4.3.2.2.1.14.

B4.3.2.2.1.15 Service Mission Planners

See Section 4.3.2.2.1.15.

B4.3.2.2.1.16 Theater Battle Management Core System (TBMCS)

See Section 4.3.2.2.1.16.

B4.3.2.2.1.17Guardrail Common Sensor Aerial Common Sensor (ACS) Integrated Processing Facility (IPF)

See Section 4.3.2.2.1.17.

B4.3.2.2.1.18Modernized Imagery Exploitation System (MIES)

See Section 4.3.2.2.1.18.

B4.3.2.2.1.19 Enhanced Tactical Radar Correlator (ETRAC)

See Section 4.3.2.2.1.19.

B4.3.2.2.1.20Contingency Airborne Reconnaissance System (CARS)

See Section 4.3.2.2.1.20.

B4.3.2.2.1.21Common Operational Modeling, Planning, and Simulation System (COMPASS)

See Section 4.3.2.2.1.21.

B4.3.2.2.2 Power Interface s Characteristics

See Section 4.3.2.2.2

B4.3.2.2.2.1 UPS to External Power Interface Characteristics

See Section 4.3.2.2.2.1.

The UPS shall physically connect to and operate with shipboard power sources. [SSS319] [SSS320]

B4.3.2.2.2.2 TCS Computer to UPS Interface Characteristics

See Section 4.3.2.2.2.2.

B4.3.2.2.2.3 Datalink Command Modules to UPS Interface Characteristics

See Section 4.3.2.2.2.3.

B4.3.2.2.3 Image System Interface Characteristics

See Section 4.3.2.2.3.

B4.3.2.2.3.1 Image Product Library Interface Characteristics

See Section 4.3.2.2.3.1.

B4.3.2.2.3.2 Direct Dissemination Element Interface Characaterisitics

See Section 4.3.2.2.3.2.

B4.3.2.2.4 Launch and Recovery Interfaces

See Section 4.3.2.2.4.

B4.3.2.2.4.1 Common Automated Recovery System (CARS)

See Section 4.3.2.2.4.1.

B4.3.2.2.4.2 Integrated Beacon Landing System (IBLS)

See Section 4.3.2.2.4.2.

B5 Requirements Traceability

B6 Notes